



## Workshop Manual Fox 2004 ➤

### 4 - Cyl. injection engine (1.4 l)

Engine ID

BKR

Edition 05.2014



## List of Workshop Manual Repair Groups

### Repair Group

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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.





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## 00 – Technical data

### 1 Technical data

(VRL006748; Edition 05.2014)

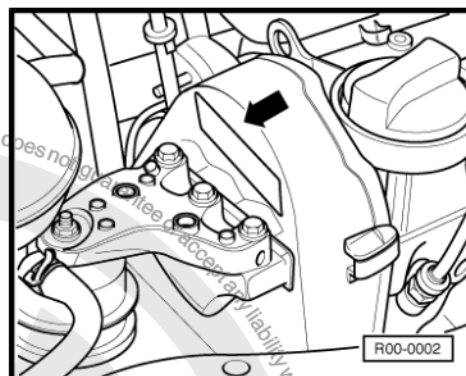
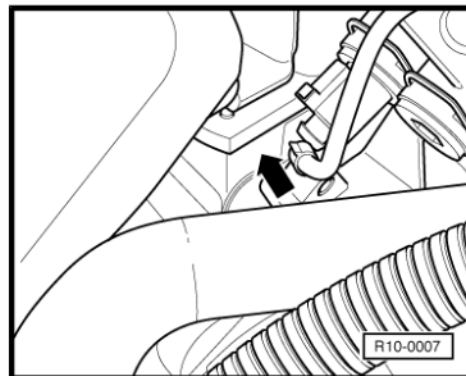
#### 1.1 Engine number

The engine number ("identification letters" and "serial number") is engraved on the engine block, under the thermostat valve body.

The engine number is comprised of nine digits (alphanumeric) at most. The first part (max. of three identification letters) represents "the engine identification letters"; the second part (six characters) represents the "serial number". If more than 999,999 engines with the same engine codes are produced, the first of the six digits is replaced by a letter.

Additionally, there is a sticker -arrow- containing the "engine codes" and "series number" on the mechanical distribution cover.

The "engine identification letters" are also shown on the vehicle data plate.



#### 1.2 Engine characteristics

Engine codes		BKR
Production		12/2004 to 09/2010
Cylinder volume	cm <sup>3</sup>	1390
Power	kW/rpm	55,0/5000
Torque setting	Nm/rpm	124,0/2750
Bore	Ø mm	76,5
Stroke	mm	75,6
Compression rate		10,5:1
Octane rating	minimum	<sup>1)</sup> 95 lead-free
Injection, ignition		MARELLI 4EV
Knock control		1 knock sensor
Self-diagnosis		yes
Lambda adjustment		2 probes
Catalytic converter		yes

1) In exceptional cases, octane rating of at least 91, but with reduced power

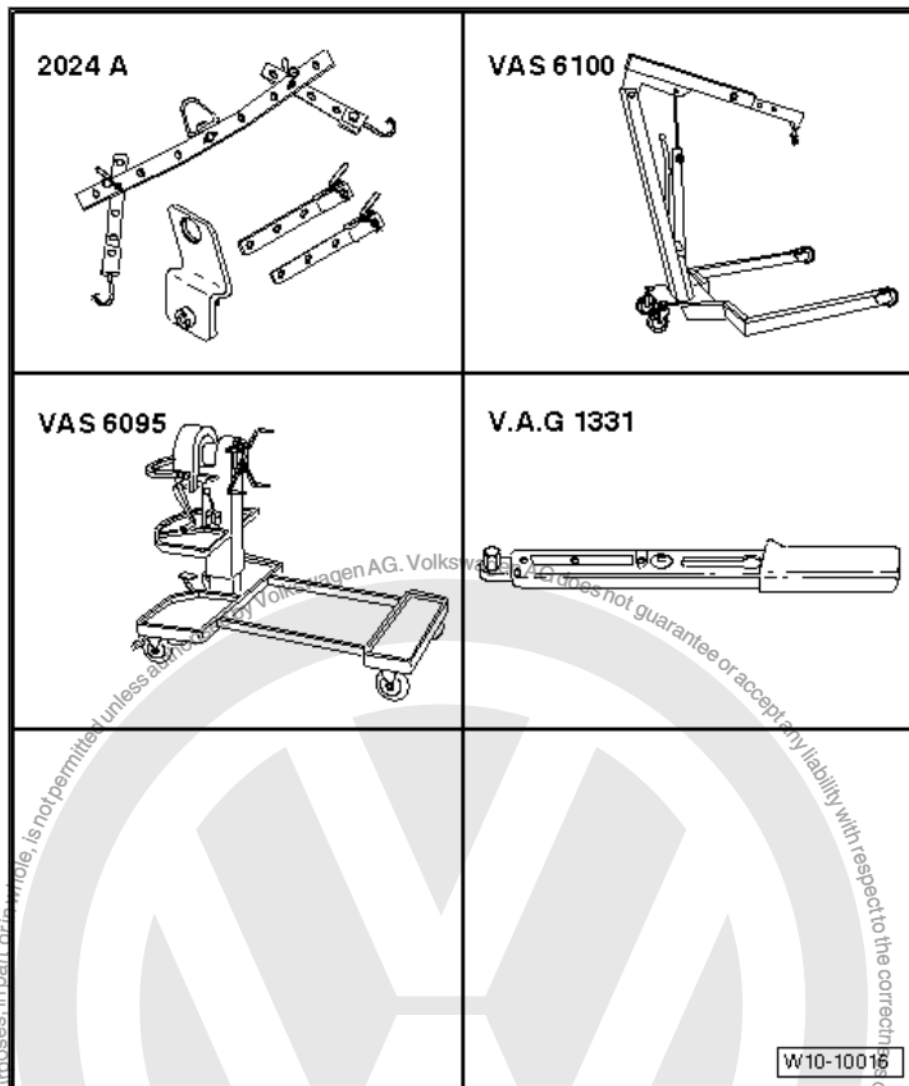


## 10 – Removing and installing engine

### 1 Engine - remove and install

Special tools and workshop equipment required

- ◆ Hanger or 2024A - VW 055-
- ◆ Hydraulic moving hoist - 500Kg or VAS 6100 - EQ 7025-
- ◆ Rollover stand for the engine and gearbox - VAS 6095-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-





- ◆ Torque meter - 40 to 200 Nm (enc. 1/2") - VAG 1332-

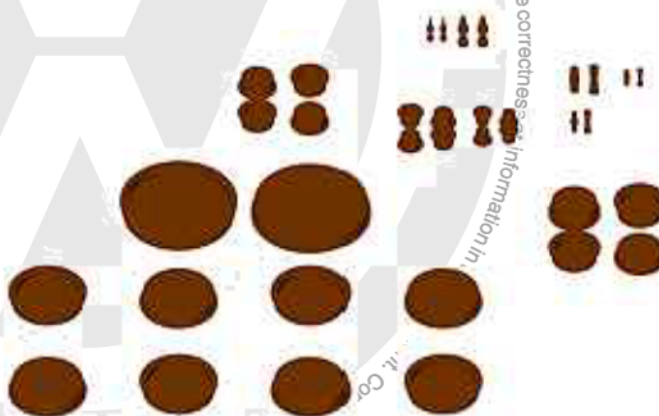
## V.A.G 1332



W00-11165

- ◆ Sealing plug kit (engine) - VAS 6122-

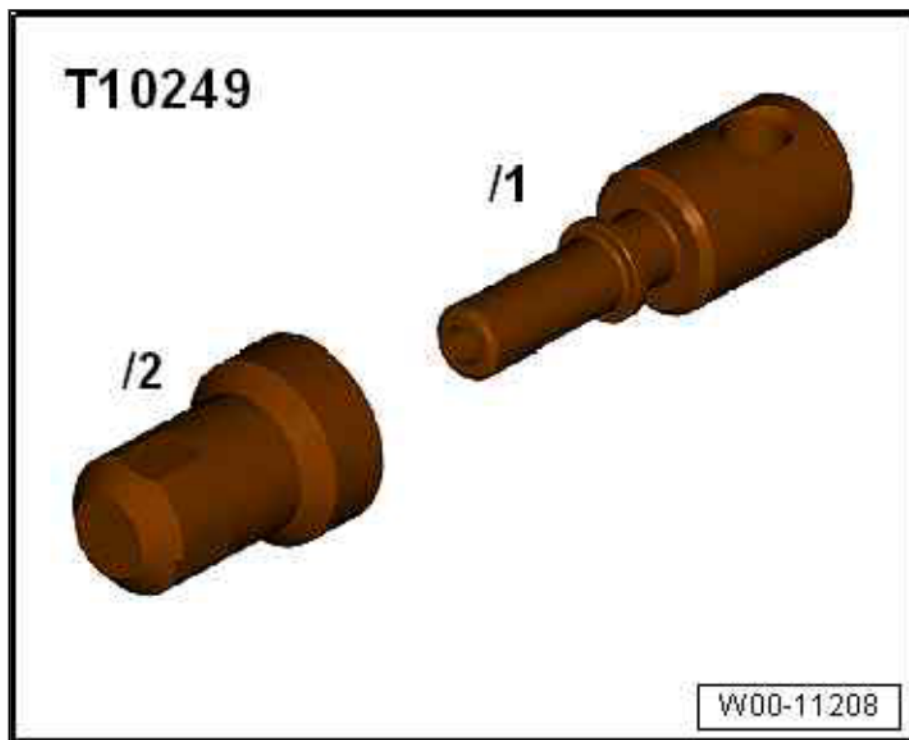
## VAS 6122



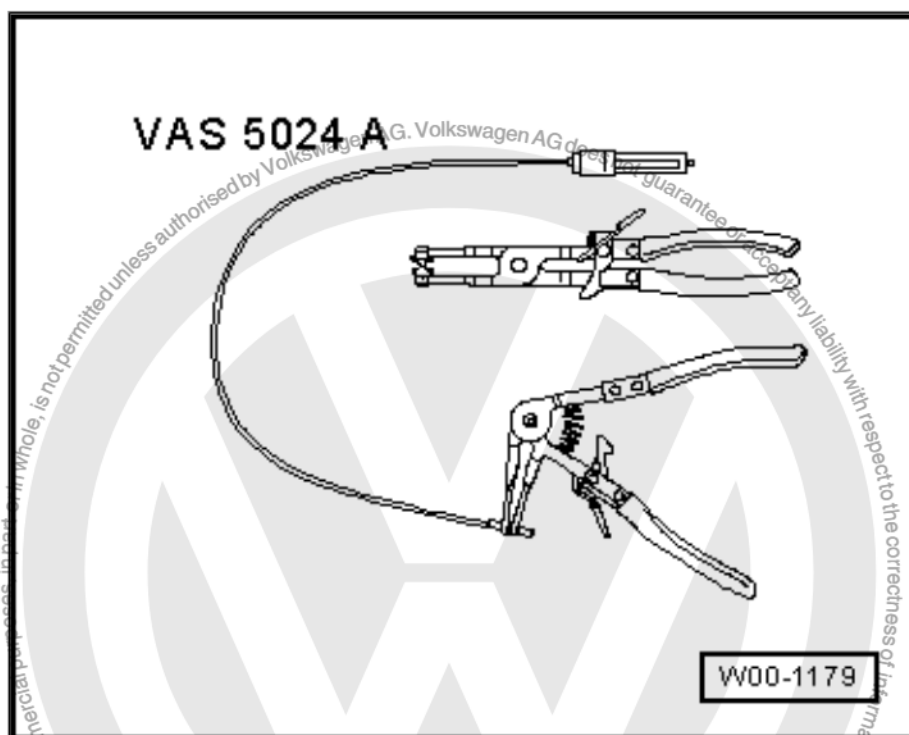
W00-11228



- ◆ Pipe sealing tool - T10249-



- ◆ VAS 5024A or Standard-type clamp pliers - VW 5162-



No illustration:

Lifting eyelets -030 103 390 F- (on pulley side), -030 103 390 G- (on inertial flywheel side).

- ◆ Lubricating grease - G 000 100- (vehicles with mechanical transmission)
- ◆ Cable tie





## 1.1 Removal - recommendations



### Note

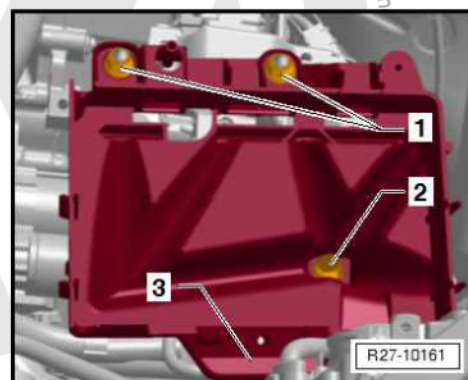
*Check if the vehicle has a coded radio, if so, check the anti-theft code before disconnecting the mass cable from the battery.*

- The engine is removed from the front along with the transmission.
- With ignition off, disconnect earth strap from the battery.
- All cable clamps that open or break during engine removal must be replaced and installed in the same locations when engine is reinstalled.
- Remove the air filter housing ⇒ [page 131](#) .
- Remove the Battery and the Battery support -arrows- ⇒ Electrical equipment; Rep. gr. 27 ; Starter, generator, battery .
- Open and close the coolant reservoir lid to depressurize the cooling system.



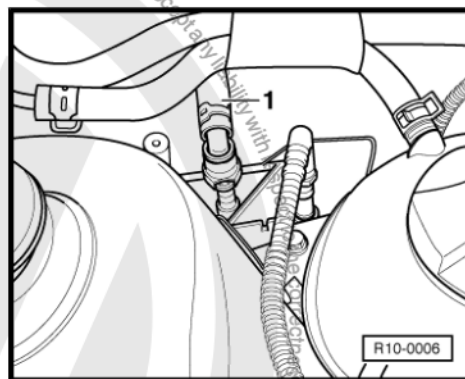
### WARNING

*Fuel supply hose is under pressure. Wrap hose connections in cloth prior to loosening. Next, eliminate pressure by carefully removing hose.*





- Loosen the fuel supply pipes -1- (press the key to unlock it).
- Loosen the hose of the Magnetic valve for activated charcoal filter - N80- in the intake manifold.
- Close pipes so that no dirty comes into the fuel supply system.
- Follow cleaning rules ⇒ [page 106](#) .
- Loosen or disconnect the following components:
  - ◆ Intake manifold vacuum hose to servo brake.
  - ◆ Connector of the Engine speed sensor - G28- and Intake manifold pressure sensor - G71- / Air intake temperature sensor - G42- .
  - ◆ Connector for the Ignition transformer - N152- , Sensor Hall - G40- and Throttle valve control unit - J338- .
  - ◆ Connector for the Coolant temperature sensor - G62- and the Oil pressure switch - F1- .
  - ◆ Injection valve connectors.
  - ◆ Lambda probe - G39- connector.
  - ◆ Double connector of the Knock control 1 - G61- .
- Remove/disconnect and loosen all transmission electric cables, Generator (Alternator) - C- and Starter - B- .
- Remove/disconnect and loosen all of the other electric cables necessary for the engine.
- Remove vacuum and vent hoses from the engine.
- Remove the lower engine noise insulation: ⇒ Body – Repair; Rep. gr. 50 ; Body - front part .
- Disconnect exhaust tube from the exhaust manifold  
⇒ [page 148](#) .





- Loosen pendulum support -arrows-.
- Release the transmission gearshift mechanism: ⇒ Automatic / mechanical transmission; Rep. gr. 34 ; Drive, housing .
- Remove the hydraulic clutch drive cylinder: ⇒ Automatic / mechanical transmission; Rep. gr. 30 ; Clutch - control system .



Note

*Clutch pedal must not be depressed.*

- Drain cooling system ⇒ [page 90](#) .
- Remove engine cooling system hoses with VAS5024A or Standard-type clamp pliers - VW 5162- .

Vehicles with air conditioning

- Remove the Poly-V belt ⇒ [page 18](#) .
- Remove air conditioning compressor: ⇒ Ventilation system; Rep. gr. 87 ; Air conditioning .
- Observe additional indications and installation works ⇒ [page 12](#) .

Continuation for all vehicles

- Remove the power steering oil pump and put it aside, together with the local hoses ⇒ Chassis; Rep. gr. 48 ; Steering .
- Loosen right and left drive shafts in the transmission and secure them on top :⇒ Running gear; Rep. gr. 40 ; Front suspension .
- Remove front panel and its components, supporting them ⇒ Body - External assembly works; Rep. gr. 50 ; Body - Front part .

Disconnect cooling system lines from the engine cylinder head.

- Install lifting eyelets in the place of the cooling fluid pipes on cylinder head. Tightening torque: 25 Nm.
- Fasten with the Lifting tackle - 2024A- as described below and raise it slightly with the hoist:

Belt pulley side: Hole of the perforated horizontal bar in position 1-.

Engine flywheel side: Hole of the perforated horizontal bar in the position 5-.



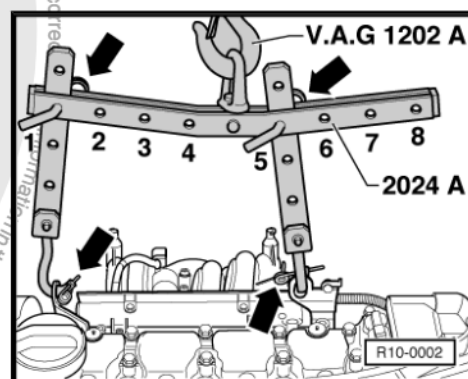
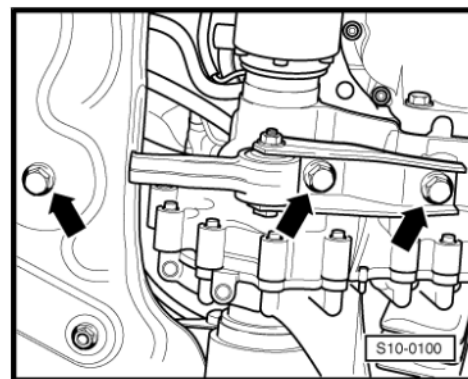
WARNING

*Use safety locks on the hooks and pins -arrows-.*



Note

- ◆ *Positions numbered -1...4- on suspension bar are positioned toward the pulley.*
- ◆ *The holes in the supports are counted from the hook.*





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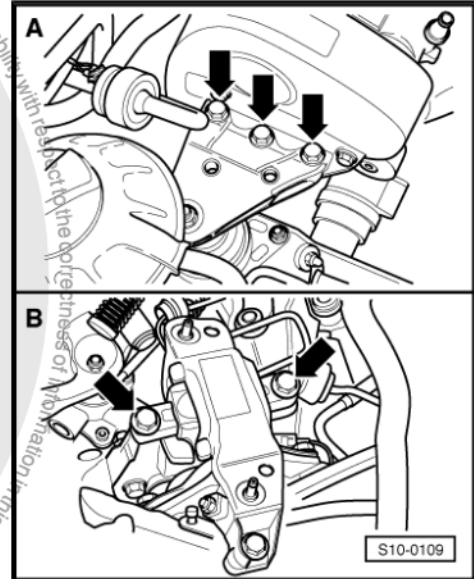
- Loosen the assembly in the transmission support -B- and in the engine support -A- -arrows-.
- Lower the assembly until it comes out of the transmission housing.

Remove the assembly from the front. In this case, the assembly must be turned and lowered quickly if necessary.



#### Note

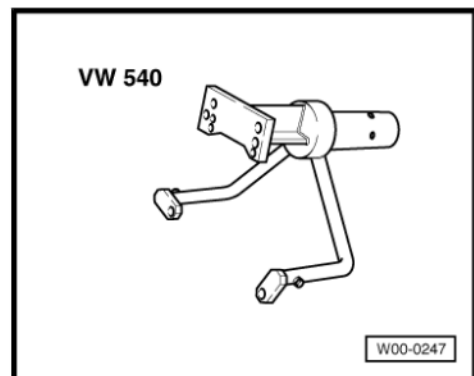
*The assembly must be carefully carried when removed, so as to avoid damage to the body.*



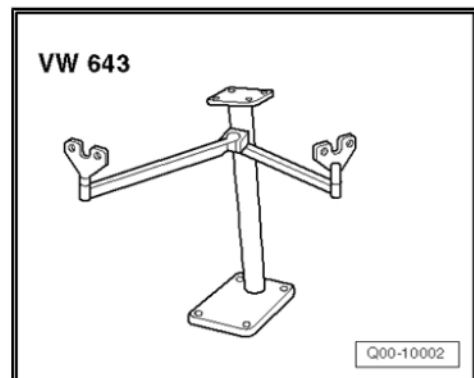
## 1.2 Engine - fasten to assembly stand

Special tools and workshop equipment required

- ◆ Support - VW 540-



- ◆ Support for VW 643 or VW 643/1 - VW 313-



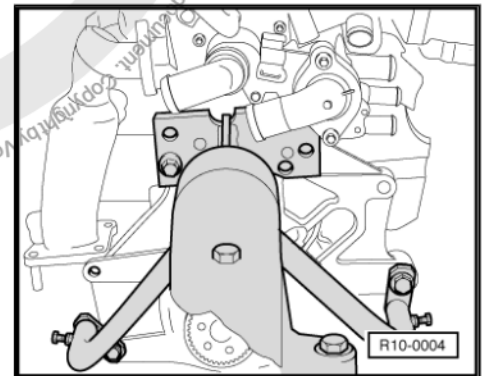


- ◆ Rollover stand for the engine and gearbox - VAS 6095-



#### Operation sequence

- Remove the flange from the transmission.
- Remove the pressure plate.
- Remove flywheel.
- Remove intermediate plate.
- Fasten the engine with the Support - VW 540- on the Support - VW 313- or Rotary stand for engine and transmission - VAS 6095- .



### 1.3 Installation notes

Installation is performed in the reverse sequence to the removal, considering the following:



#### WARNING

*Remember the following when performing installation work, especially inside the engine compartment where there is little space:*

- ◆ *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling fluid and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.*
- ◆ *Allow easy access to all the moving or hot parts.*

- Check the clutch roller bearing for wear and replace if necessary.
- Lightly lubricate the clutch roller bearing and the primary shaft bearing guide sleeve with Lubricating grease - G 000 100- .
- If necessary, check that the clutch disc is centralized.
- Check that the guides for coupling the engine and gearbox are placed on the engine block and, if necessary, install them.

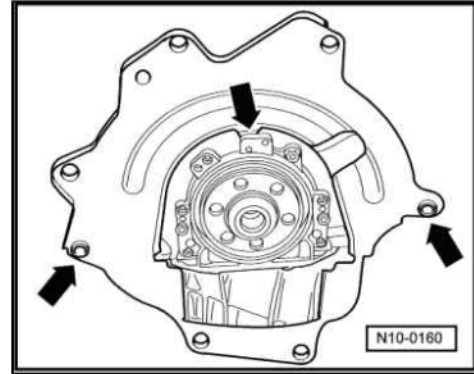




- Engage the intermediate plate on the sealing flange and move it towards the sleeves -arrows-.
- When the assembly is installed, make sure the drive shafts pass freely.
- Align the engine, moving it quickly so that the supports fit without tension.

**Note**

*Tightening torque for the assembly ⇒ [page 11](#) .*



- Install drive shafts: ⇒ Running gear; Rep. gr. 40 ; Front suspension .

**Vehicles with air conditioning**

- Install air conditioning compressor.
- Install power steering pump.
- Install Poly-V belt ⇒ [page 18](#) .

**Continued for all vehicles:**

- Electric connections and positioning: ⇒ Electrical equipment; Rep. gr. 97 ; Wiring harnesses and cables :
- Install the hydraulic clutch drive cylinder: ⇒ Automatic / mechanical transmission; Rep. gr. 30 ; Clutch - control system .
- Install gear shifting mechanism: ⇒ Automatic / manual gearbox; Rep. gr. 34 ; Drive, housing .
- Install front exhaust pipe onto exhaust manifold ⇒ [page 148](#) .
- Install engine compartment lower noise insulation: ⇒ Body - Repair; Rep. gr. 50 ; Body - Front part .
- Replenish cooling system ⇒ [page 90](#) .
- Loosen lifting eyelets from the engine cylinder head.
- Install cooling system pipes on engine cylinder head. Tightening torque: 25 Nm.
- Install air filter housing ⇒ [page 133](#) .
- Adjust the Engine control unit - J623- to the Accelerator butterfly valve control unit - J338- ⇒ [page 144](#) .
- Carry out a test run and check the event memory ⇒ [page 144](#) .

**14****Tightening torques**

Location		Tightening torque
Screws, nuts	M 6	10 Nm
	M 8	20 Nm
	M 10	45 Nm
	M 12	60 Nm
Different tightening torques		
Exhaust pipe on the exhaust manifold		40 Nm



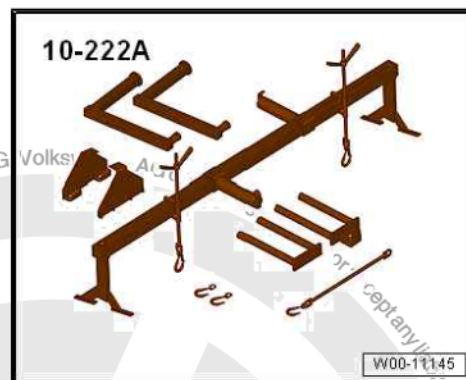
**i** Note

*Tightening torque for the assembly housing ⇒ [page 11](#).*

## 1.5 Power-drive unit supports

Special tools and workshop equipment required

- ◆ Support device - 10-222A- and Adapter - 10-222 A/1-



- ◆ Torque meter - 5 to 50 Nm ( enc. 1 1/2" ) - VAG 1331-



- ◆ Torque meter - 40 to 200 Nm ( enc. 1 1/2" ) - VAG 1332-



### 1.5.1 Tightening torques

**i** Note

*The assembly housing fastening screws are expansion screws and must be replaced.*



**WARNING**

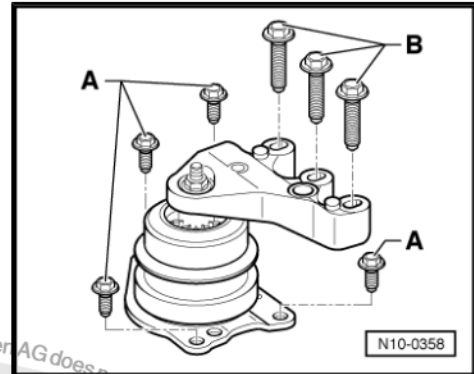
*Always replace self-locking nuts and screws subject to angular torque*

**Power-drive group support (engine side):**

◆ A<sup>2)</sup> = 20 Nm + 90°

◆ B<sup>2)</sup> = 30 Nm + 90°

2) Replace.

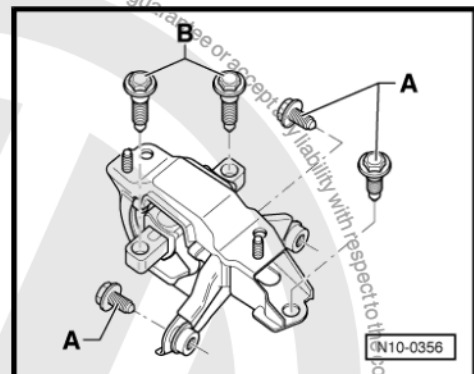


**Power-drive group support (transmission side):**

◆ A<sup>3)</sup> = 50 Nm + 90°

◆ B<sup>3)</sup> = 40 Nm + 90°

3) Replace.

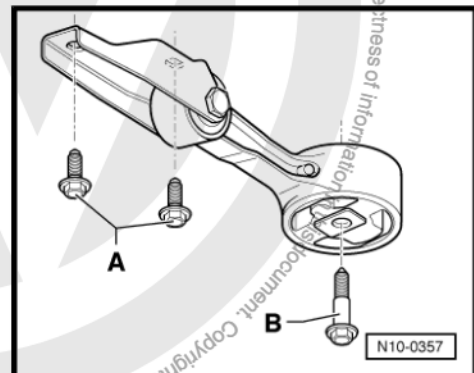


**Pendulum support (torque restrainer):**

◆ A<sup>4)</sup> = 30 Nm + 90°

◆ B<sup>4)</sup> = 40 Nm + 90°

4) Replace.



## 1.6 Additional notes and installation works in vehicles with air conditioning



**WARNING**

*The cooling gas circuit for the air conditioner should not be opened.*



**Note**

*To avoid damage to the condenser and cooling gas hoses, do not kink, twist nor overstretch the hoses.*





To remove and install the engine without opening the cooling gas loop:

- Remove cooling gas hose clamp(s).
- Remove the Poly-V belt ➔ [page 18](#) .
- Remove front panel and its components ➔ Body - Repair; Rep. gr. 50 ; Body - Front part .
- Move the panel with radiator and condenser sideways in such a way that the cooling gas hoses are not stretched.
- Remove air conditioning compressor and anchor it to the body.  
➔ Aeration system; Rep. gr. 87 ; Air conditioning .





## 13 – Crankshaft group

### 1 Engine - assembly and disassembly



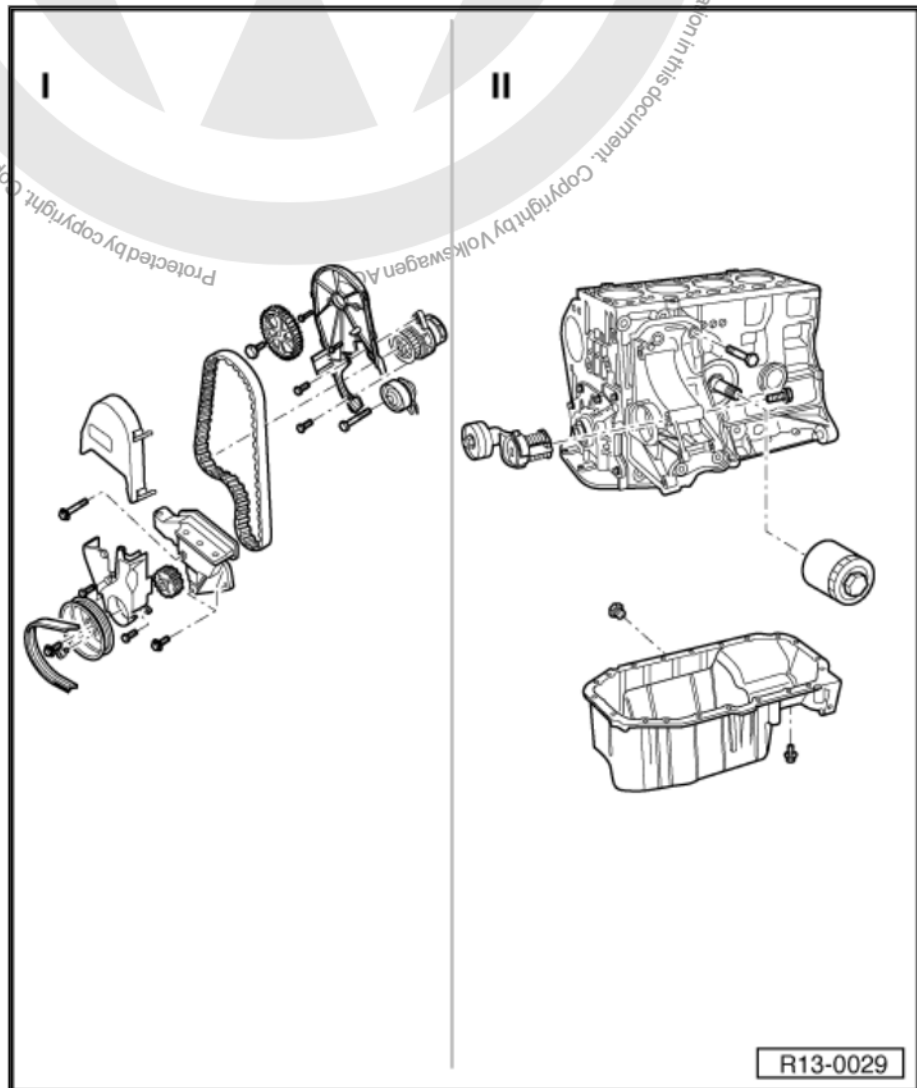
#### WARNING

*Always replace self-locking nuts and screws subject to angular torque*



#### Note

*For carry out assembly works, fasten the engine to the assembly stand by using the Support - VW 540-.*





**i** Note

- ◆ When significant quantities of metal chips and filings appear in the engine oil during engine repair due to crankshaft and rod bearing wear, the oil filter must be replaced and the oil grooves must be carefully cleaned.
- ◆ All contact and bearing surfaces must be lubricated with oil before assembly.



**WARNING**

Always replace self-locking nuts and screws subject to angular torque

I ➔ page 15

II ➔ page 16

**Part I**

1 - Upper part of the cover of the mechanical distributor

2 - Toothed belt

- ☐ Mark rotation direction before removal.
- ☐ Check for wear.
- ☐ Do not bend.
- ☐ Removal, installation and adjustment ➔ page 45.

3 - Tighten to 20 Nm + 90°

- ☐ Replace after each removal.
- ☐ To loosen and tighten, immobilize the camshaft gear with the Special wrench - 3036-.

4 - Camshaft gear

- ☐ Check the fastening during installation.
- ☐ Check the installation position of toothed belt ➔ page 45.

5 - 10 Nm

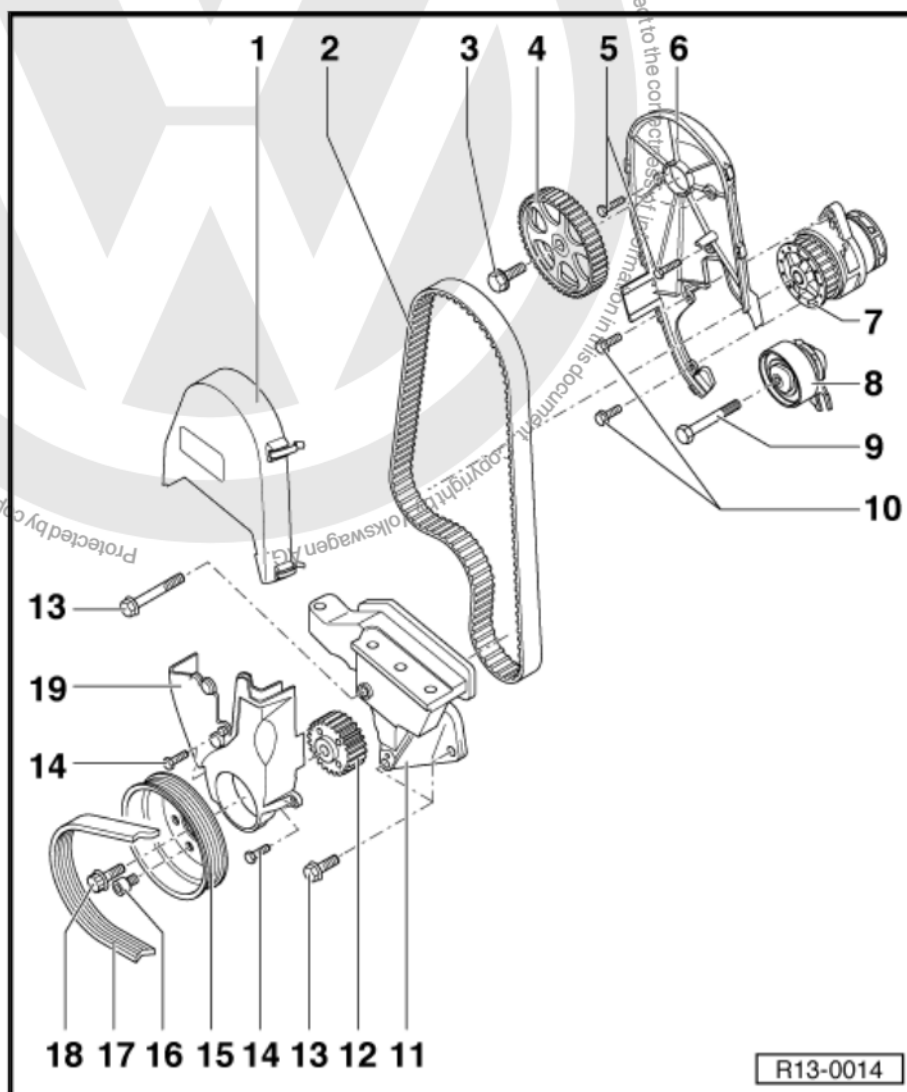
- ☐ Apply Liquid sealant - D 000 600 A2-.

6 - Mechanical distribution rear cover

7 - Water pump

- ☐ With integrated sealing gasket.
- ☐ The sealing gasket must not be separated from the water pump.

- ☐ In case of damages and leaks, replace the entire pump together with the sealing.





- ☐ Check that it turns smoothly.
- ☐ Removal and installation ⇒ [page 100](#) .
- 8 - Toothed belt tensioning pulley
  - ☐ Check ⇒ [page 43](#) .
  - ☐ Drive belt: removal, installation and adjustment ⇒ [page 45](#) .
- 9 - 25 Nm
- 10 - 20 Nm
- 11 - Engine support
- 12 - Crankshaft gear
  - ☐ Check installation position of toothed belt ⇒ [page 45](#) .
- 13 - 50 Nm
- 14 - 10 Nm
- 15 - Crankshaft pulley
- 16 - 15 Nm + 40°
  - ☐ Replace after each removal.
- 17 - Poly-V belt
  - ☐ Mark rotation direction before removal.
  - ☐ Remove and install of Poly-V belt ⇒ [page 18](#) .
  - ☐ Poly-V belt trajectory ⇒ [page 21](#) .
- 18 - 90 Nm 90°
  - ☐ Replace after each removal.
  - ☐ To loosen and tighten, use Wrench - 3415- .
  - ☐ Tightening continuation can be carried out in several steps.
  - ☐ Tightening continuation angle can be measured with a common angle measuring disc, for example, Hazet 6690.
- 19 - Lower cover to the mechanical distributor

## Part II



### Note

*Clutch repairs: ⇒ Automatic / manual transmission ; Rep. gr. 30 ;  
Clutch - command system .*



### WARNING

*Always replace self-locking nuts and screws subject to angular torque*



# 1 - Engine block

- ☐ Removal and installation of the crankshaft ➤ [page 35](#) .
- ☐ Remove and install pistons and connecting rods ➤ [page 37](#) .

## 2 - 50 Nm

- ☐ Tightening sequence: first tighten the upper right screw, then the lower right screw, and finally the left screw (front view, in the direction the vehicle moves).

## 3 - Oil filter

- ☐ Loosen through hex or without nut with the Oil filter puller (14 faces) - VW 5005P- .
- ☐ Hand tighten.
- ☐ Follow the oil filter installation instructions.

## 4 - Bolt

- ☐ M8 = 20 Nm + 90° (replace)
- ☐ M10 = 45 Nm

## 5 - 10 Nm 90°

- ☐ Replace after each removal.
- ☐ Loosen fastening screws from the engine block crankcase, on the pulley side (4 units), from inner side of the the crankcase.

## 6 - Crankcase

- ☐ Clean the sealing surfaces before installation.
- ☐ Install with Silicone sealant for engine - D 176 404 A2 ou A3- .
- ☐ Remove and install ➤ [page 74](#) .

## 7 - Oil draining plug, 30 Nm

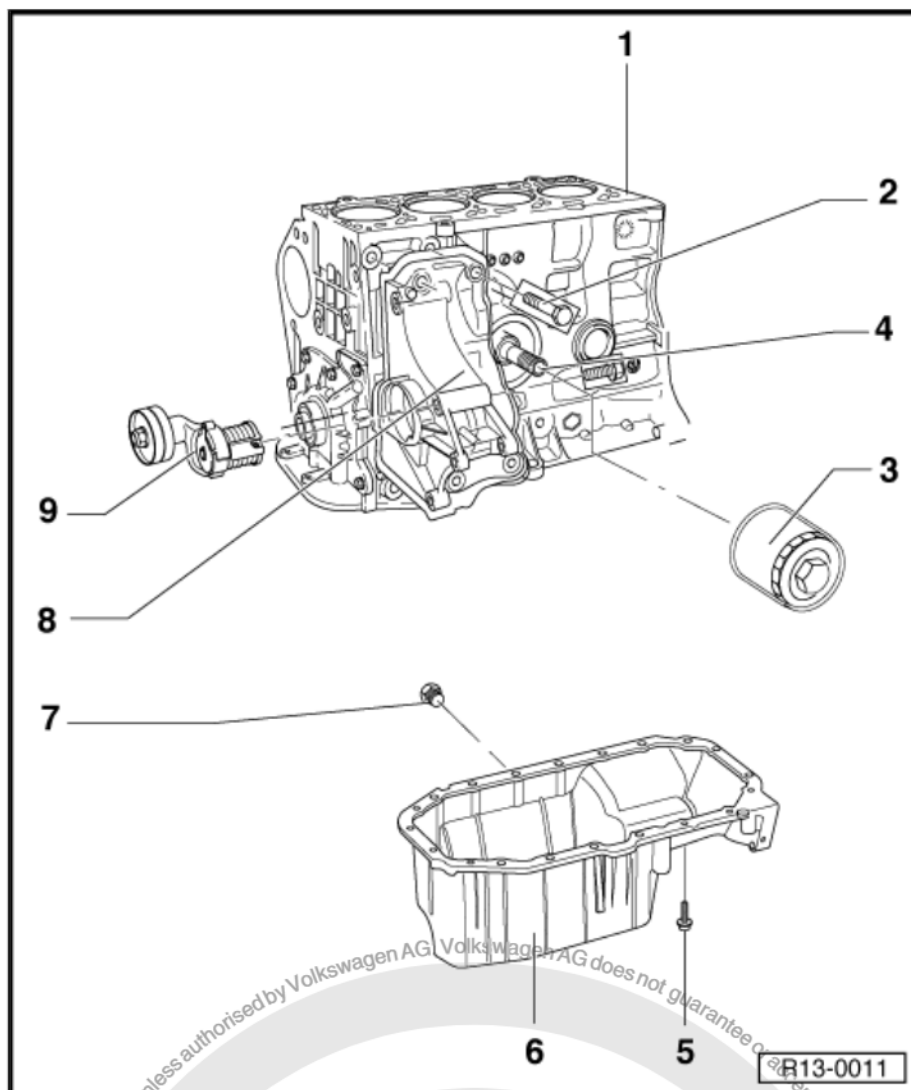
- ☐ With integrated sealing ring
- ☐ Replace.

## 8 - Compact support

- ☐ To the Generator (Alternator) - C- , air conditioning compressor and Poly-V belt fastening element.
- ☐ Remove and install compact support in vehicles with air conditioning: ➤ Heating - ventilation; Rep. gr. 87 ; Air conditioning

## 9 - Tensioning pulley

- ☐ For Poly-V belts.
- ☐ For vehicles with air conditioning only.
- ☐ To loosen Poly-V belt, turn with 16-mm wrench.
- ☐ Remove and install of Poly-V belt ➤ [page 18](#)

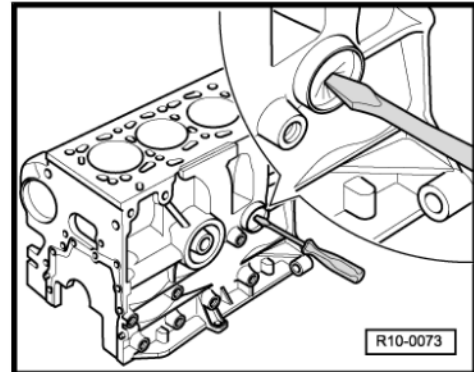




## 1.1 Seal lid - replace

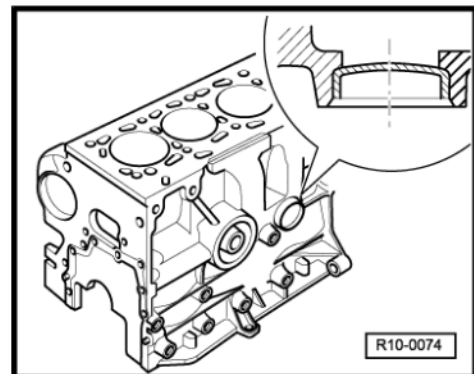
### 1.1.1 Removal

- Removal must be executed with a screwdriver after boring with a chisel.



### 1.1.2 Installation

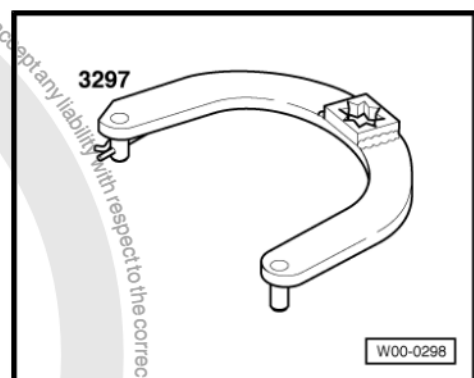
- Installation must be carried out with a driftpin in the cover diameter and depth must be kept at the bevel height. Upon installation, apply adhesive ⇒ Chemicals Manual .



## 1.2 Poly-V belt - remove and install

Special tools and workshop equipment required

- ◆ 16-mm wrench
- ◆ Lever - 3297-







- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2") - VAG 1331-

V.A.G 1331



W00-11166

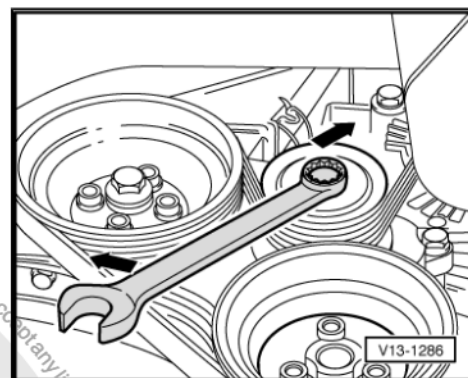
## 1.2.1 Removal

Vehicles with air conditioning

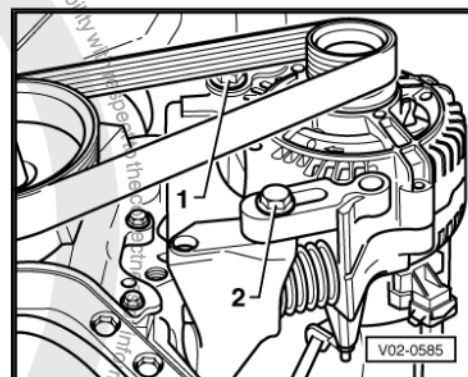
- Remove lower noise insulation from engine compartment: ⇒ Body - Repair; Rep. gr. 50 ; Body - Front part .
- Mark the Poly-V belt movement direction.
- To release the Poly-V belt, turn the belt tensioning element towards the arrow, with the 16-mm spanner .
- Remove the Poly-V belt.

Vehicles without power steering and air conditioning

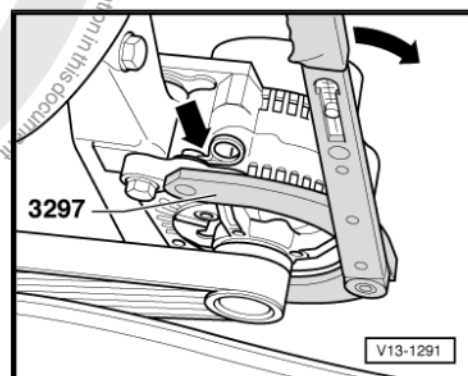
- Mark the Poly-V belt movement direction.



- Loosen the fastening screws -1- and -2-, at least by one turn.



- Position the Lever - 3297- , lock with fitting pin and turn the Generator (Alternator) - C- downwards (with the Lever - 3297- operation, utilize for example the torque wrench).
- Remove the Poly-V belt.





## 1.2.2 Installation



### Note

- ◆ Before installing the Poly-V belt, make sure all assemblies (Generator (Alternator) - C-, air conditioning compressor) are well installed.
- ◆ While installing the Poly-V belt, observe the proper moving direction and seating of the belt on pulley.

#### Vehicles with air conditioning

- First, place the Poly-V belt on the crankshaft pulley. Then, place the belt on the tensioning element.

Installation is performed in the reverse order to removal.

When the job is finished, always:

- Start the engine and check the belt motion.

#### Vehicles without power steering and air conditioning

- Press the Generator (Alternator) - C- up to the tensioning spring stop with the Lever - 3297- at least three times, to ensure optimized rotation.
- Then press the Generator (Alternator) - C- with the Lever - 3297- against the belt tensioning element until the Poly-V belt can be installed on the pulley.
- After placing the Poly-V belt, turn the engine several times with the Generator (Alternator) - C- loosened (approx. 11 revs). For that, slightly start the Engine - B- .



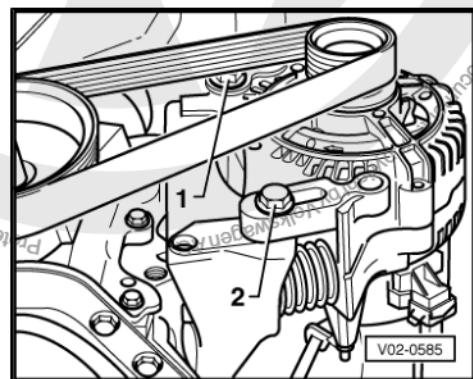
### Note

When tightening the Generator (Alternator) - C- screws, observe the tightening sequence and do not touch the Poly-V belt.

- First tighten the fastening screw -2- to 25 Nm, then the fastening screw -1- to 25 Nm.

After completing the works:

- Start the engine and check the belt motion.



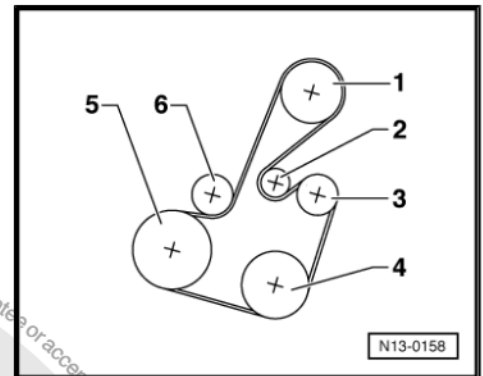




### 1.2.3 Poly-V belt track

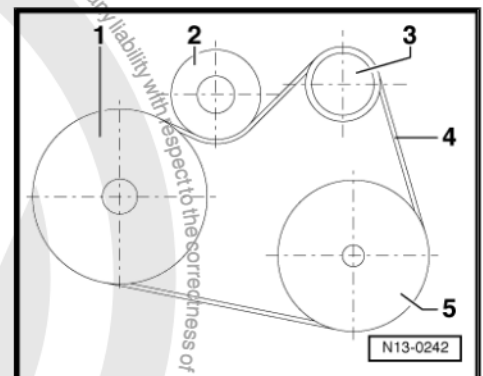
Belt path with air conditioning and with power steering

- 1 - Power steering pump pulley
- 2 - Return pulley
- 3 - Generator (Alternator) - C- pulley
- 4 - Air conditioning compressor pulley
- 5 - Crankshaft pulley
- 6 - Tensioning pulley



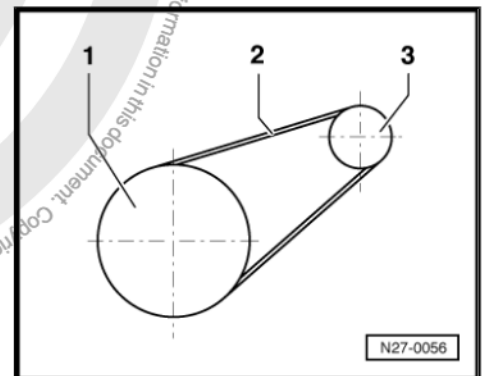
Belt path without air conditioning and with power steering

- 1 - Crankshaft pulley
- 2 - Tensioning pulley
- 3 - Generator (Alternator) - C- pulley
- 4 - Poly-V belt
- 5 - Power steering pump pulley



Belt path without air conditioning and without power steering.

- 1 - Crankshaft pulley
- 2 - Poly-V belt
- 3 - Generator (Alternator) - C- pulley





## 2 Crankshaft flanges - removal and installation



### WARNING

*Always replace self-locking nuts and screws subject to angular torque*



### Note

*Clutch repairs: ➔ Automatic / manual transmission ; Rep. gr. 30 ;  
Clutch - command system .*

1 - 10 Nm

2 - Suction duct

3 - Engine block

- ☐ Disassembly and assembly of the crankshaft  
➔ [page 35](#) .
- ☐ Disassembly and assembly of the pistons and connecting rods  
➔ [page 37](#) .

4 - Knock sensor 1 - G61-

5 - 20 Nm

- ☐ Tightening the torque influences the operation of the Knock Sensor 1 - G61- .

6 - 60 Nm 90°

- ☐ Replace after each removal.

7 - Flywheel

- ☐ For removal and installation of the flywheel, immobilize it with the Lock - 3067- .
- ☐ Remove and install  
➔ [page 23](#) .

8 - Intermediate plate

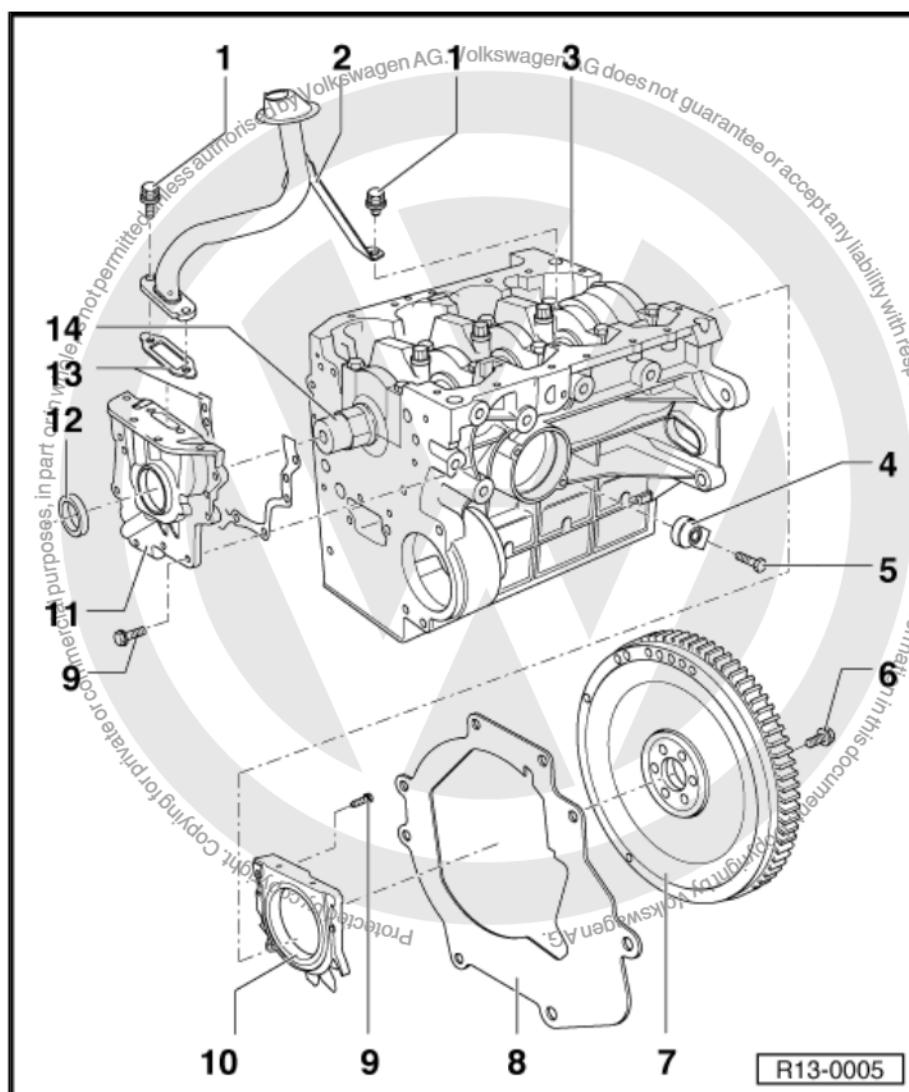
- ☐ It must be seated on the coupling guides.
- ☐ Do not damage/bend during installation.

9 - 6 Nm + 40°

- ☐ Replace after each removal.

10 - Crankshaft flange (flywheel side) with Engine speed sensor - G28- rotor and seal.

- ☐ Always replace completely with Engine speed sensor - G28- rotor and seal.
- ☐ Use the support sleeve supplied for installation.
- ☐ To remove and install, remove oil pan.





- ☐ Do not lubricate nor apply oil to the sealing lip of the seal.
- ☐ Before installation, remove oil residues from crankshaft trunnion with a clean cloth.
- ☐ The support sleeve will only be able to be removed after moving the flange over the crankshaft trunnion.
- ☐ Removal and installation of the flange ⇒ [page 26](#).

#### 11 - Crankshaft flange (pulley/oil pump side)

- ☐ Replace complete only.
- ☐ It must be seated on the guides.
- ☐ To remove and install, remove oil pan.
- ☐ Pay careful attention to the position of the crankshaft trunnion during installation, ⇒ [Item 14 \(page 23\)](#).
- ☐ Removal and installation of the oil pump ⇒ [page 79](#).

#### 12 - Crankshaft seal (pulley side)

- ☐ Replace ⇒ [page 24](#).

#### 13 - Sealing gasket

- ☐ Replace after each removal.

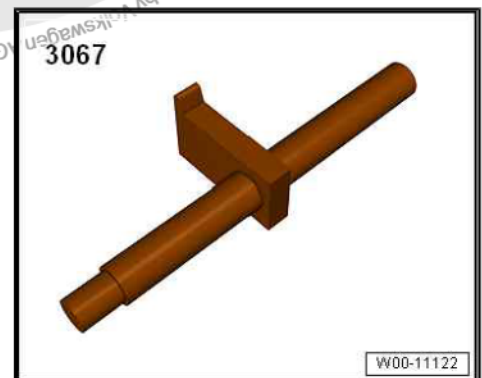
#### 14 - Crankshaft trunnion

- ☐ Apply oil before installing the oil pump.

## 2.1 Flywheel - remove and install

Special tools and workshop equipment required

- ◆ Lock - 3067-



#### Removal

- Gearbox removed.



- Install the Lock - 3067- in the cylinder block; position -B-.
- Remove the fastening bolts from the flywheel.
- Remove flywheel.

#### Installation

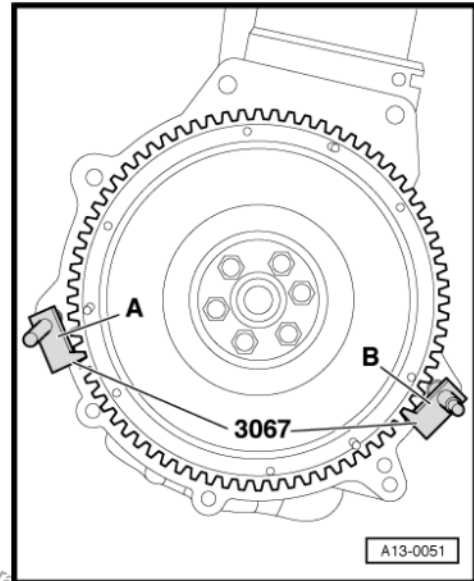
Installation is performed in reverse sequence to the removal, observing the following:



#### Note

- ◆ Replace the fastening bolts submitted to angular torque.
- ◆ The flywheel may only be installed in one position.

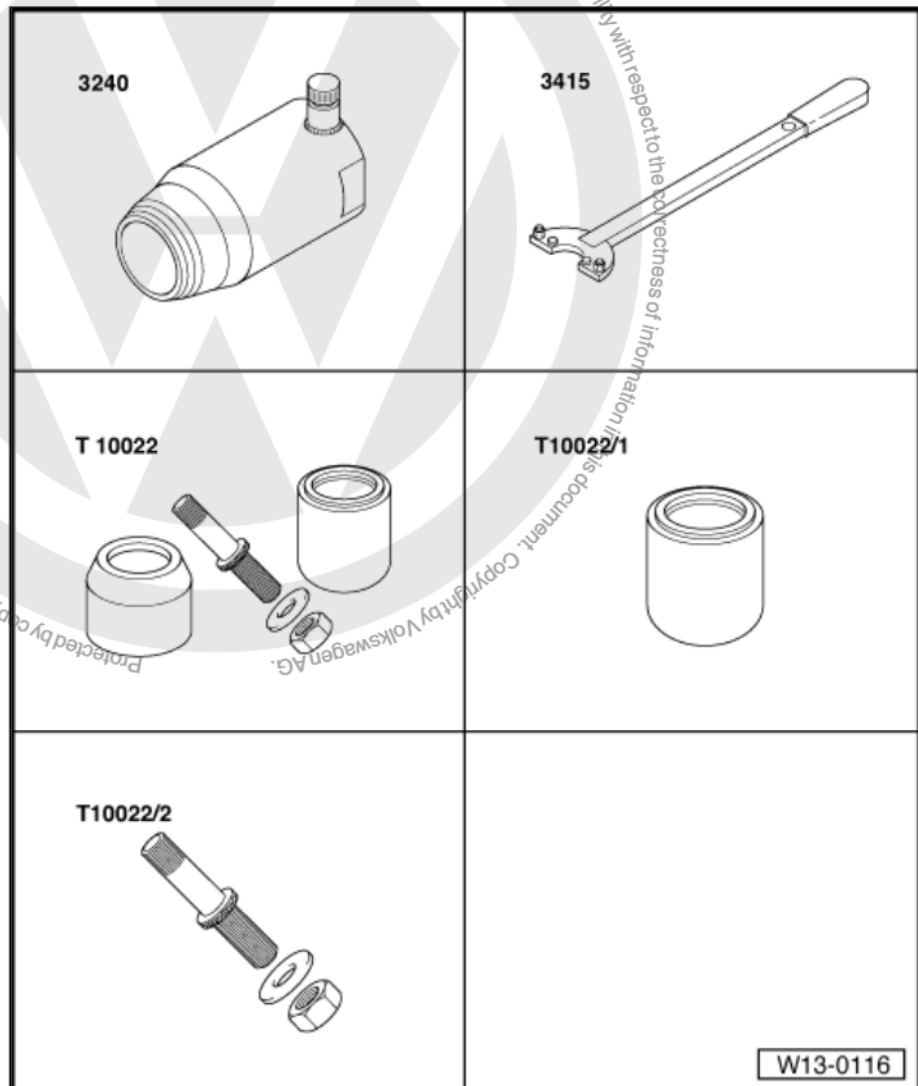
- Install the flywheel and fastening bolts.
- Install the Lock - 3067- in the cylinder block; position -A-.
- Apply the indicated torque to the flywheel fastening bolts  
⇒ [Item 6 \(page 22\)](#)



## 2.2 Crankshaft seal (pulley side) - replace

#### Special tools and workshop equipment required

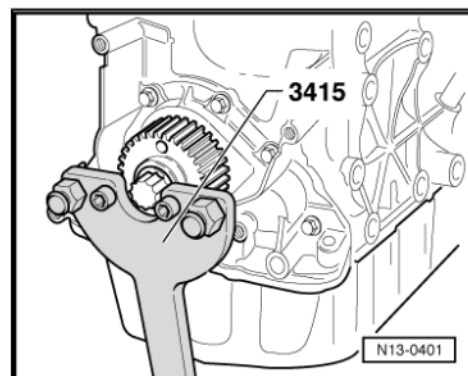
- ◆ Puller - 3240-
- ◆ Key - 3415-
- ◆ Assembly sleeve - T10022-
- ◆ Sleeve - T10022/1-
- ◆ Spindle T10022/2-



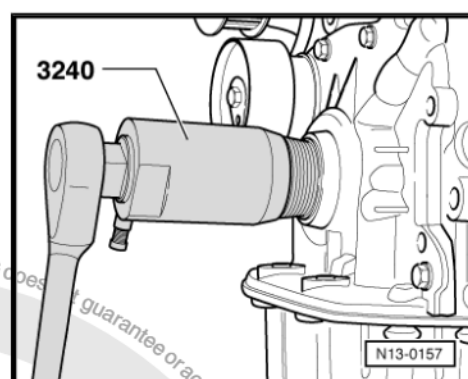


## 2.2.1 Removal

- First, remove timing belt ➔ [page 45](#) .
- Remove crankshaft gear. For this purpose, immobilize the gear with the Wrench - 3415- .
- To guide the seal Extractor - 3240- install the gear fastening screw to the crankshaft stop.
- Turn the inner part of the Extractor - 3240- twice (approx. 3 mm) from the external part, and lock it with the splined screw.

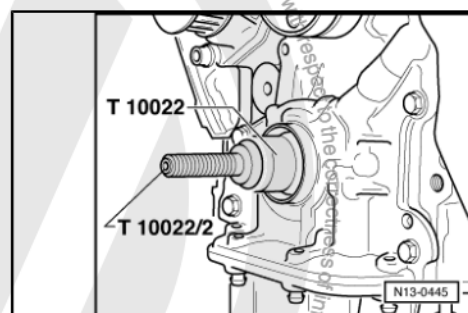


- Lubricate the threaded head of the Extractor - 3240- , seat and screw it by applying as much force to the seal as possible.
- Loosen the splined bolt and turn the inner part against the crankshaft until the seal is extracted.

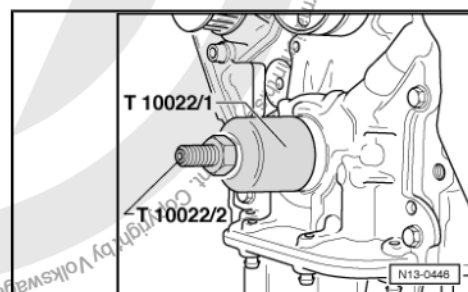


## 2.2.2 Installation

- Quickly lubricate the sealing lip of the seal with oil.
- Apply the Assembly sleeve - T10022- on the crankshaft trunnion and screw with threaded part up to the stop.
- Displace the seal through the guide sleeve.



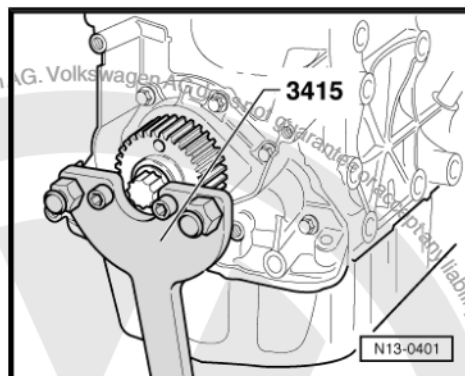
- Compress the seal with the Sleeve - T10022/1- to the stop.





- Install the crankshaft gear and immobilize with the Spanner - 3415- .
- Tighten new screw to 90 Nm and turn it 90° further (there may be several stages of tightening).

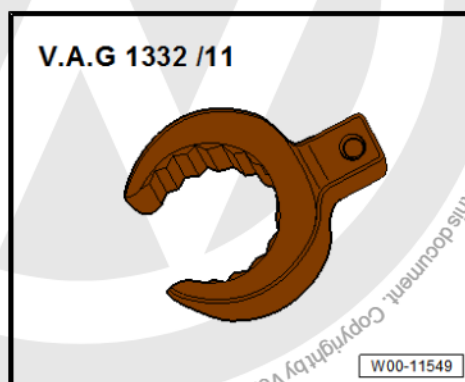
Installing the toothed belt and regulating command times  
⇒ [page 45](#) .



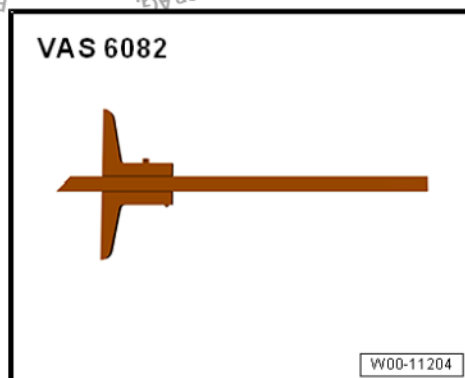
## 2.3 Crankshaft flange (flywheel side) - replace

Special tools and workshop equipment required

- ◆ Spanner insert 24 - VAG 1332/11-



- ◆ Depth calliper - 1/20 - 300 mm - VAS 6082-



- ◆ Fitter - T10134- or Fitter - T10017K-







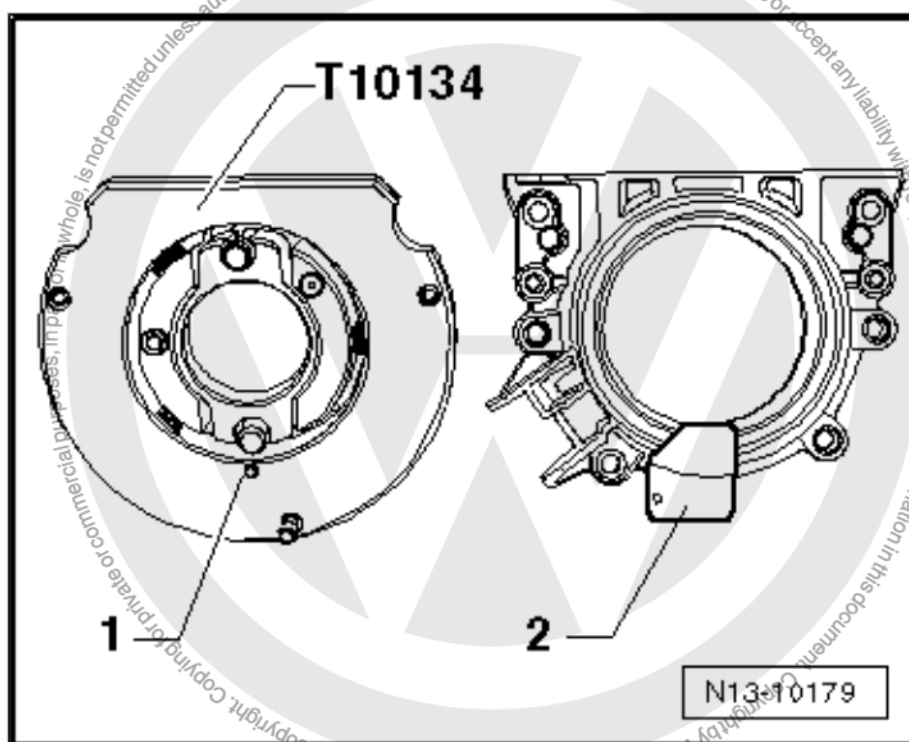
- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2") - VAG 1331-

V.A.G 1331



W00-11166

- ◆ Feeler gauge
- ◆ Three hexagonal head screws M6×35 mm
- ◆ Fitter - T10134-



#### Note

*For SABÓ flange, use Fitter - T10017K- or Fitter - T 10134- , and for Freudenberg flange, use Fitter - T10017- . The method is the same for both tools. The reference for installing the tool rotor flange is: upper portion SABÓ and lower portion Freudenberg.*



### 2.3.1 Remove crankshaft flange (flywheel side) with the rotor of the Engine speed sensor - G28-

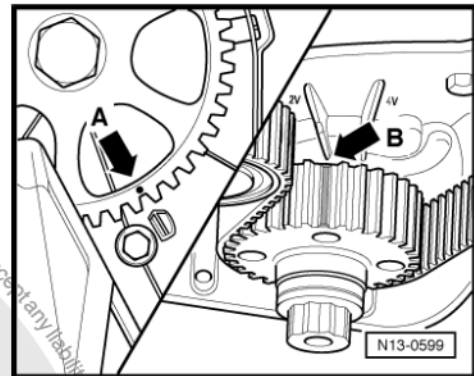


#### Note

- ♦ To show work sequences better, they are carried out with the engine removed.
- ♦ The work sequences with both engine and gearbox removed are identical.

#### Operation sequence

- Remove flywheel.
- Remove intermediate plate.
- Place the camshaft gear on the mark -arrow A-.
- Put the crankshaft in cylinder 1 TDC. The tooth marked on the camshaft gear must align with the mark "2V" on the flange -arrow B-.
- Remove the oil pan → [page 74](#).



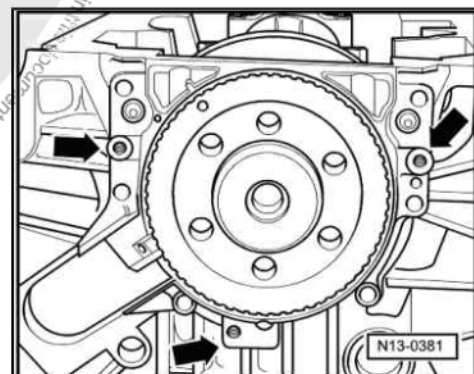
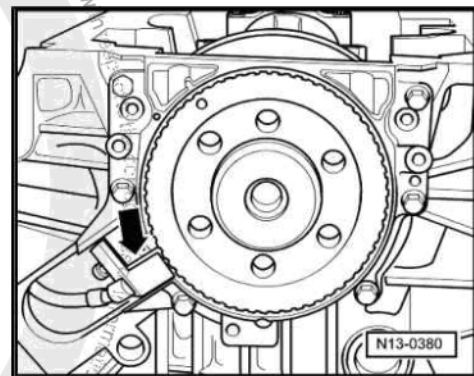
- Remove the Engine speed sensor - G28- -arrow-.
- Loosen flange fastening screws.



#### Note

The flange and rotor are removed together from the crankshaft with three screws M 6 × 35 mm.

- Install the three M 6 × 35 mm screws in the threaded holes of the flange -arrows-.
- Turn the screws alternately (max. one 1/2 turn (180°) per screw) in the flange and remove from the crankshaft the flange with the Engine speed sensor - G28- rotor.





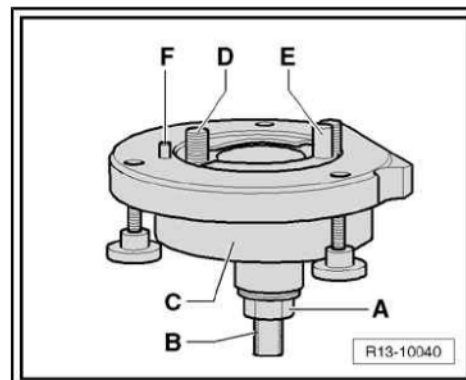


## 2.3.2 Installation of the the flange with the rotor of the Engine speed sensor - G28-



### Note

- ◆ For SABÓ flange, use Fitter - T10017K- or Fitter - T 10134- , and for Freudenberg flange, use Fitter - T10017- . The method is the same for both tools. The reference for installing the tool rotor flange is: upper portion SABÓ and lower portion Freudenberg.
- ◆ The flange with PTFE sealing ring comes with sealing lip thrust ring. This thrust ring works as an installation sleeve and should not be removed before installation.
- ◆ The flange and the Engine speed sensor - G28- rotor can no longer be separated or turned after being removed from the spare parts packaging.
- ◆ The Engine speed sensor - G28- rotor reaches its installation position after being secured to the Fitter fastening pin.
- ◆ The flange and seal form a single unit and can only be replaced together with the Engine speed sensor - G28- rotor.
- ◆ The installation position of the Fitter is relative to the crankshaft by means of a guide pin, which is guided through a threaded hole on the crankshaft.



A - hexagonal nut

B - threaded spindle

C - assembly case

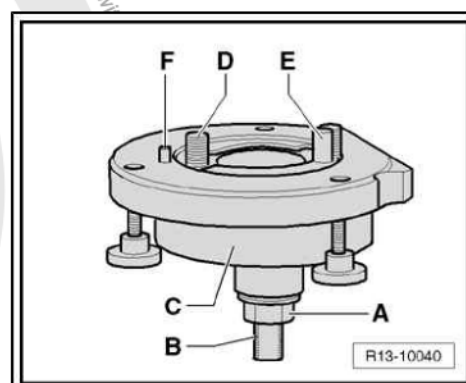
D - Allen screw

E - guide pin

F - fastening pin

A - Install sealing flange with the Engine speed sensor - G28- rotor onto Fitter

- Install the hex nut -A- to just before the tightening flat surface -B- of the threaded spindle.



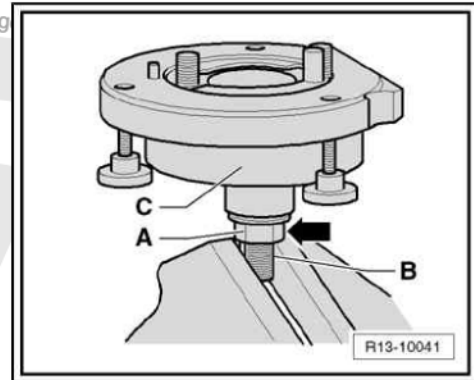


- Fasten the Fitter on the tightening surface -B- of the threaded part in a vise.
- Press the assembly housing -C- downwards, so that it is supported on the hex nut -A- -arrow-.



Note

*The inner part of the Fitter and assembly housing must be on the same plane.*

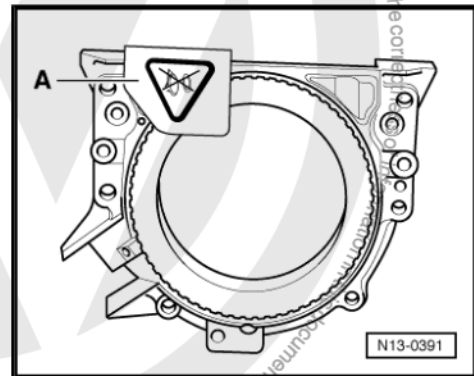


- Remove the safety clip -A- from the new flange.

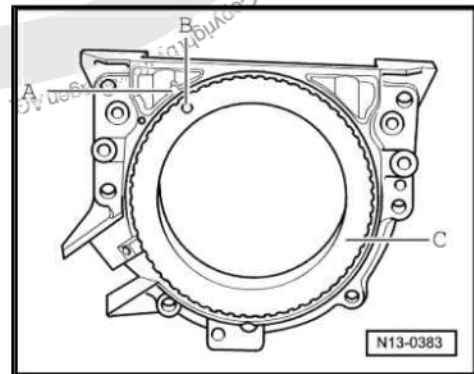


Note

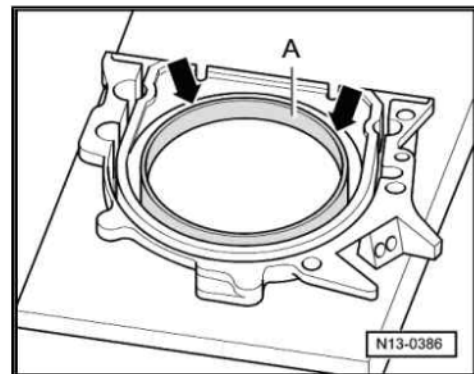
*The Engine speed sensor -G28- rotor cannot be removed from the flange or turned.*



The fastening hole -B- in the rotor of the Engine speed sensor -G28- -C- must be aligned with mark -A- on the flange.

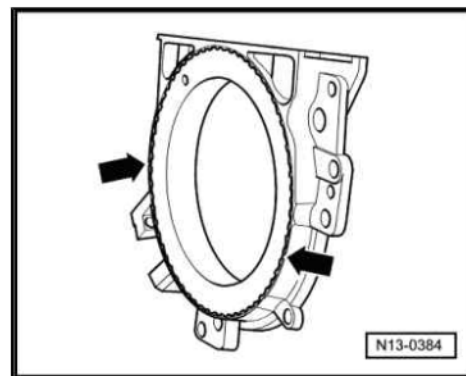


- Place the flange with the front part on a flat and clean surface.
- Press the sealing lip thrust ring -A- downwards in the direction of the arrow until it lies on the flat surface.





The upper corner of the Engine speed sensor - G28- rotor and the front corner of the flange must be aligned with each other -arrows-.

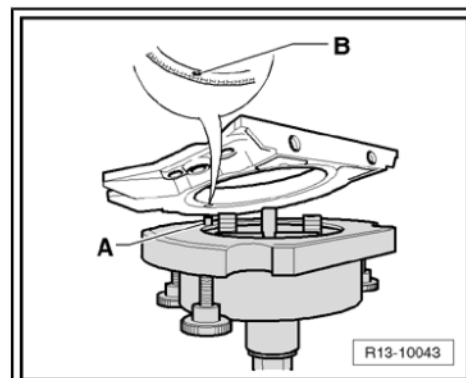


- Place the flange with the front part on the Fitter, in such a way that the fastening pin -A- is inserted into the -B- hole of the Engine speed sensor - G28- rotor.



#### Note

*Make sure the flange is flat in the Fitter.*

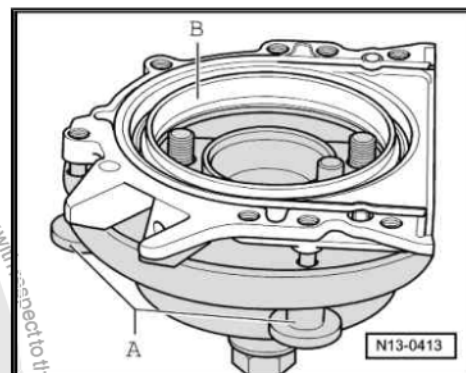


- Press the sealing lip thrust ring -B- while tightening the three splined screws -A- against the Fitter surface, so that the fastening pin can no longer escape from the hole on the Engine speed sensor - G28- rotor.



#### Note

*Ensure the Engine speed sensor - G28- rotor remains fastened to the Fitter during flange installation.*



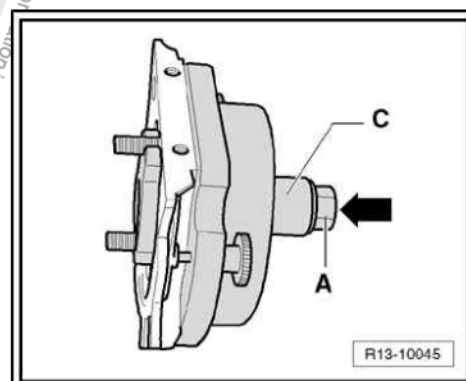
#### B - Install Fitter with flange onto crankshaft

##### Conditions

- The crankshaft trunnion must be free of oil and lubricant.
- The engine is in TDC for cyl. 1.

##### Operation sequence

- Install the hex nut -A- to the end of the threaded part.
- Press the threaded part of the Fitter in the direction of the arrow until the hex nut -A- touches the assembly housing -C-.
- Align the flat side of the assembly housing with the sealing surface on crankcase side of the block.



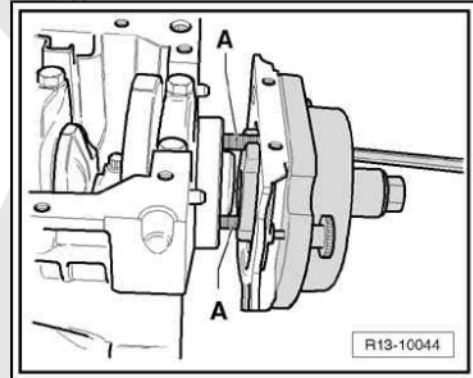


- Screw the Fitter with Allen screws -A- to the crankshaft trunnion.



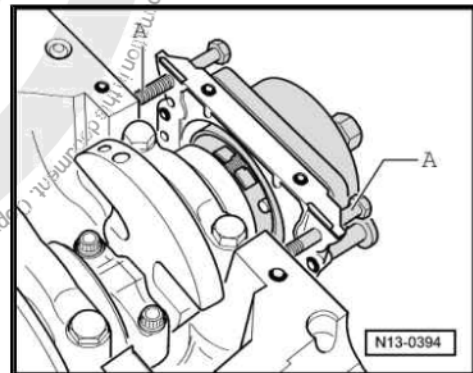
#### Note

Insert Allen screws -A- by approx. 5 threaded wire on the crankshaft trunnion.



- Install two screws M 6 × 35 mm -A- to guide the flange in the engine block.

C - Install the Fitter in the crankshaft flange



- Move the assembly case -A- manually in the arrow direction until the sealing lip thrust ring -B- touches the crankshaft flange -C-.

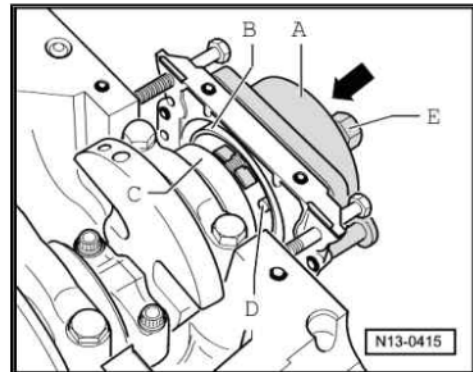


#### Note

The guide pin -D- Fitter is inserted into a threaded hole on the crankshaft during assembly. Thus, the Engine speed sensor - G28- rotor reaches the definitive assembly position.

- Keep the assembly housing in this position and manually tighten both Allen screws on the assembly device.
- Screw the hex nut -E- manually to the threaded part until it lies on the assembly housing -A-.

D - Install the Engine speed sensor - G28- rotor with the Fitter on the crankshaft flange



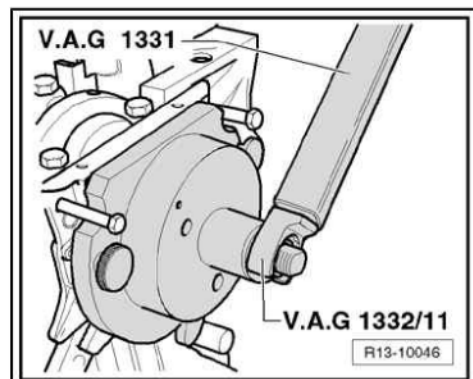
- Tighten hexagonal nut on the Fitter using the Torque wrench - 5 to 50 Nm (fit. 1/2") - VAG 1331- and Open socket SW 24 - VAG 1332/11- . Tightening torque: 35 Nm.



#### Note

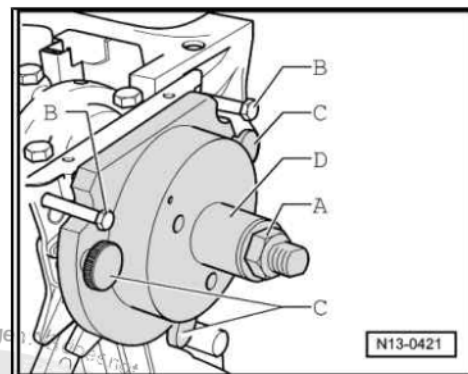
After tightening the hex nut with 35 Nm of torque, there should still be a small clearance between the engine block and flange.

E - Check the installation position of the Engine speed sensor - G28- rotor on the crankshaft

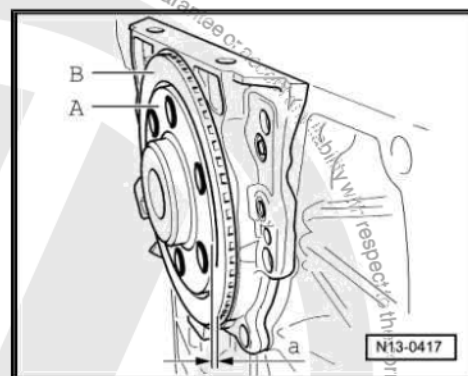




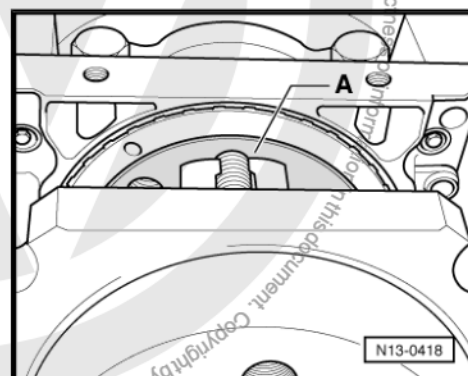
- Install the hex nut -A- to the end of the threaded part.
- Install both screws M6×35 mm -B- on the engine block.
- Loosen the three splined screws -C- from the flange.
- Remove the Fitter .
- Remove the sealing lip thrust ring.



The Engine speed sensor rotor - G28- is in the exact assembly position on the crankshaft when there is a distance -a- of 0.5 mm between the flange-A- and the Engine speed sensor rotor -B- .



- Place the Vernier calliper stem or a steel ruler against the crankshaft flange -A- (splined surface).



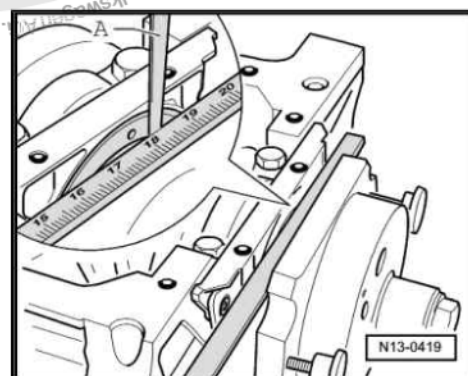
- By using a feeler gauge -A-, measure distance -a- between the Vernier calliper stem and the Engine speed sensor - G28- rotor.

If distance -a- is too small:

- Press the Engine speed sensor - G28- ➔ [page 34](#) rotor further down.

If the distance -a- is correct:

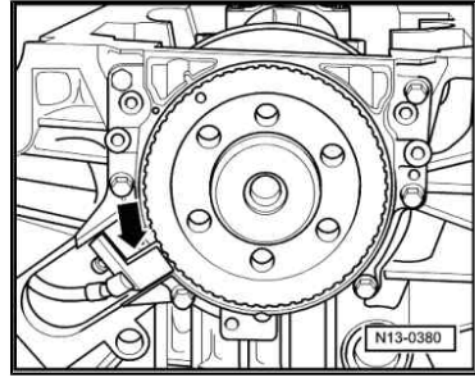
- Remove the Fitter .
- Screw the flange fastening screws alternately in a cross pattern. Tightening torque: 10 Nm.



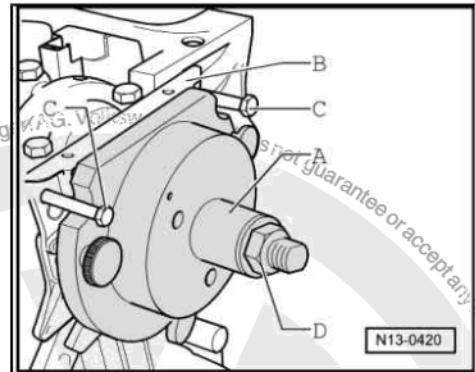


- Install the Engine speed sensor - G28- - arrow-. Tightening torque: 5 Nm.
- Install the oil pan ➔ [page 74](#) .
- Install intermediate plate.
- Install flywheel using new screws.

F - Further compress the Engine speed sensor - G28- rotor



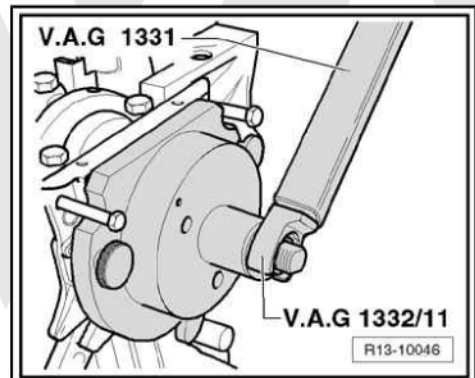
- Move the assembly housing -A- manually in the direction of the flange-B-.
- Install two screws M6×35 mm -A- to guide the flange-B- in the engine block.
- Install hex nut -D- manually on the threaded part until it lies on the assembly housing -A-.



- Tighten hexagonal nut on the Fitter using the Torque wrench - 5 to 50 Nm (fit. 1/2") - VAG 1331- and Open socket SW 24 - VAG 1332/11- . Tightening torque: 40 Nm.
- Check again the assembly position of the Engine speed sensor - G28- rotor on the crankshaft ➔ [page 32](#) .

If the distance -a- is again to small:

- Tighten the hex nut of the fitter with 45 Nm of torque once more.
- Check again the assembly position of the Engine speed sensor - G28- rotor on the crankshaft.







### 3 Crankshaft - remove and install



#### Note

- ◆ In order to carry out the assembly works, the engine must be fastened to the assembly stand with the Support - VW 540- or Rotary stand for engine and transmission - VAS 6095.
- ◆ All contact and bearing surfaces must be lubricated with oil before assembly works.

#### 1 - Dragging element

- ☐ To activate the oil pump.
- ☐ Apply oil before installing the oil pump.

#### 2 - Bearing shells 1, 2, 3, 4 and 5

- ☐ Spare parts ordering classification ➔ [page 36](#).
- ☐ For bearing cap without lubrication groove.
- ☐ For block with lubrication groove.
- ☐ Do not mix the bearing shells if they are used (mark).

#### 3 - 65 Nm

- ☐ Replace after each removal.

#### 4 - Bearing cap

- ☐ Bearing cover 1: Pulley side.
- ☐ Bearing cover 3: With grooves for fitting rings.
- ☐ Block bearing cover / bearing cover retainers must oppose each other.

#### 5 - Bearing shell 3

- ☐ ➔ [Item 2 \(page 35\)](#).
- ☐ Do not mix the bearing shells if they are used (mark).

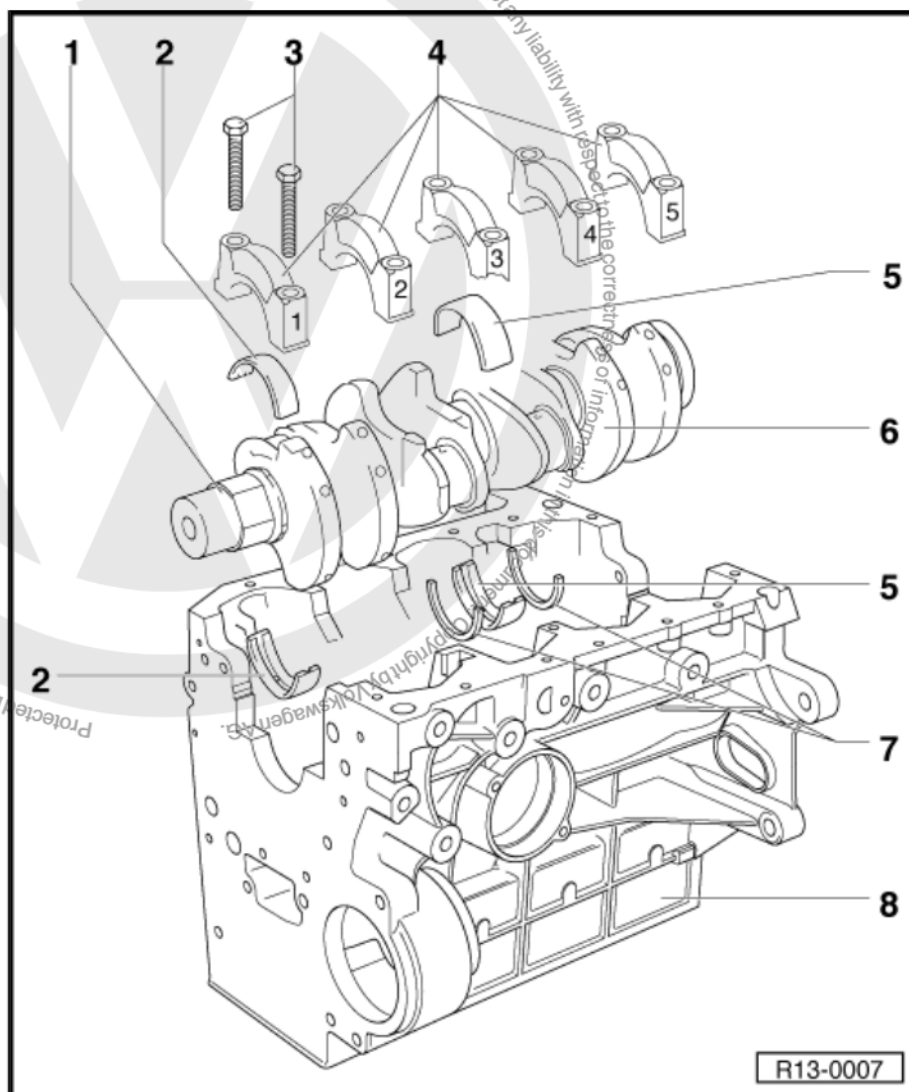
#### 6 - Crankshaft

- ☐ New axial clearance: 0.070...0.243 mm wear limit 0.263 mm.
- ☐ Measure radial clearance with new Plastigage: 0.016...0.036 wear limit: 0.070 mm.
- ☐ Do not turn the crankshaft while measuring radial clearance.
- ☐ Crankshaft dimensions ➔ [page 36](#).

#### 7 - Fitted ring

- ☐ For bearing block 3.

#### 8 - Engine block







### 3.1 Identifying engine bearing shells

- Crankshaft bearing shells are classified at the plant and marked on the engine block and crankshaft, as indicated. To identify the bearing shells, the oil pan must be removed so that the code can be read.

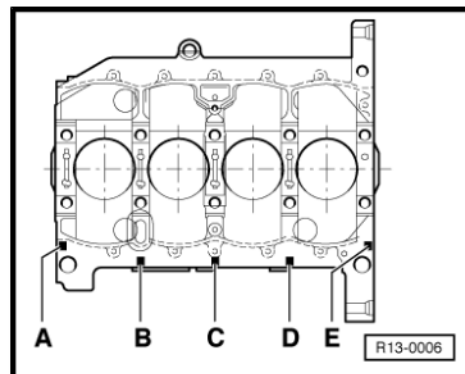
#### 3.1.1 Crankshaft upper bearing shell code



Note

- ♦ The engravings may also be grouped around the letter D of the above illustration.
- ♦ Use the yellow bearing shells (colour code G) when there is no identification.

A	=	Code for bearing 1
B	=	Code for bearing 2
C	=	Code for bearing 3
D	=	Code for bearing 4
E	=	Code for bearing 5



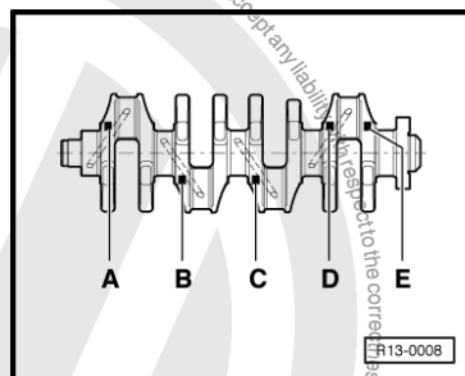
#### 3.1.2 Crankshaft lower bearing shell code



Note

It may be also engraved on the supporting face of the flywheel.

A	=	Code for bearing 1
B	=	Code for bearing 2
C	=	Code for bearing 3
D	=	Code for bearing 4
E	=	Code for bearing 5



#### 3.1.3 Colour codes

R	=	red
G	=	yellow
B	=	blue

### 3.2 Crankshaft dimensions

(dimensions in mm)

Grinding measurements	Crankshaft bearing Trunnion-Ø	Connecting rod bearing Crankpin-Ø
Basic measurement	-0,022 54,00 -0,037	-0,022 47,80 -0,037
First grinding (0.25)	-0,022 53,75 -0,037	-0,022 47,55 -0,037
Second grinding (0.50)	-0,022 53,50 -0,037	-0,022 47,30 -0,037
Third grinding (0.75)	-0,022 53,25 -0,037	-0,022 47,05 -0,037



## 4 Pistons and connecting rods - removal and installation



### WARNING

*Always replace self-locking nuts and screws subject to angular torque*



### Note

*All housing and bearing surfaces must be lubricated with oil before assembly.*

#### 1 - Piston

- ☐ Check ➔ [page 39](#)
- ☐ Mark assembly position and correspondence with the cylinder.
- ☐ Arrow on piston head points to the pulley side.
- ☐ Assemble with the piston ring tensioning strap.

#### 2 - Piston pin

- ☐ In case of difficulties during removal, heat piston to 60°C.
- ☐ Remove and install with the Fitter - 10-206-

#### 3 - Piston pin retaining ring

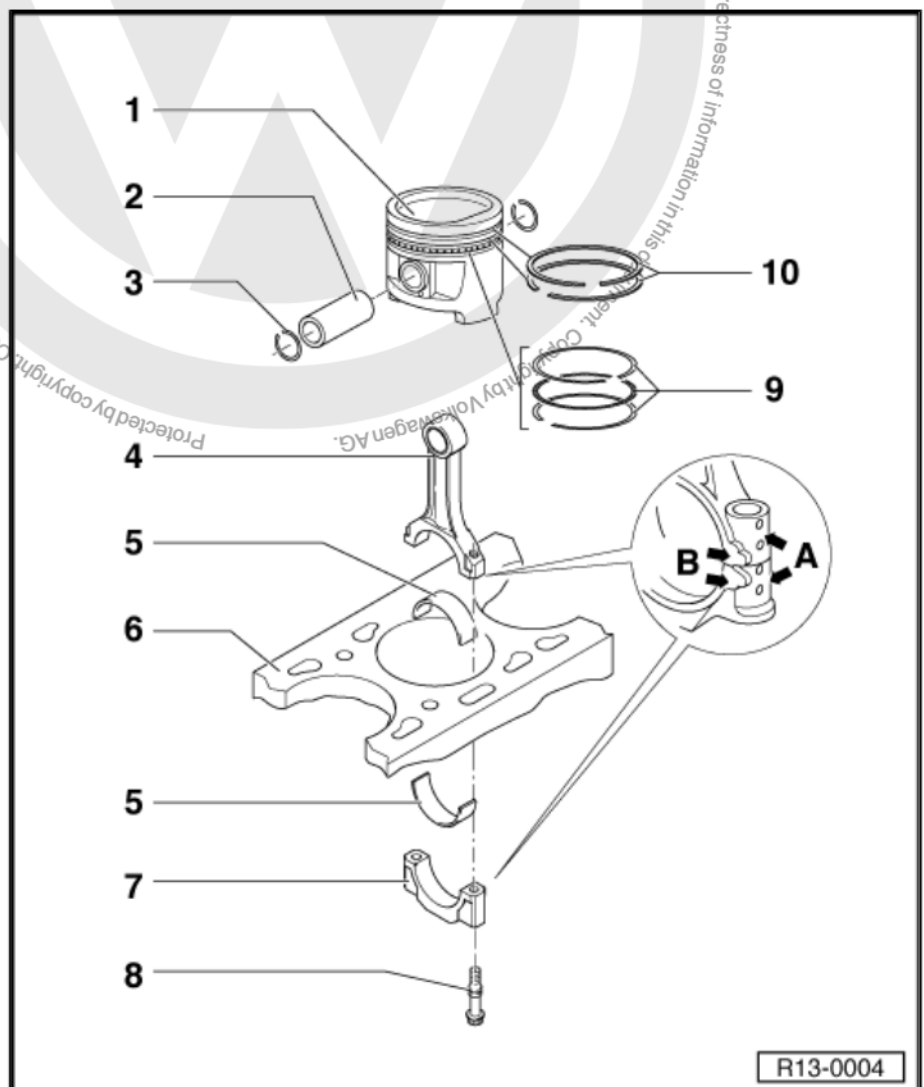
- ☐ Replace after each removal.

#### 4 - Connecting rod

- ☐ Replace it in pairs only.
- ☐ Mark corresponding position relative to cylinder -A-.
- ☐ Assembly position: marks -B- point to the flywheel side.
- ☐ Piston/connecting rod axial clearance; 0.20...0.40 mm wear limit 0.50 mm.

#### 5 - Bearing shell

- ☐ Check assembly position.
- ☐ Do not mix used bearing shells in case they are reused. Mark assembly position.
- ☐ Install bearing shells centrally.
- ☐ Measure radial clearance with new Plastigage: 0.020...0.061 wear limit: 0.091 mm. Do not rotate crankshaft while measuring radial clearance.





## 6 - Engine block

- ☐ Check cylinder diameter ➔ [page 40](#) .
- ☐ Piston and cylinder dimensions ➔ [page 40](#) .

## 7 - Connecting rod cap

- ☐ Check assembly position.
- ☐ Due to the rupture process applied to the connecting rods, the cap can be assembled in only one position and only on the respective connecting rod.

## 8 - 30 Nm 90°

- ☐ Replace after each removal.
- ☐ Lubricate threads and stop surfaces.
- ☐ Tighten with 30 Nm to measure the radial clearance, but do not keep turning.

## 9 - Oil scraper rings

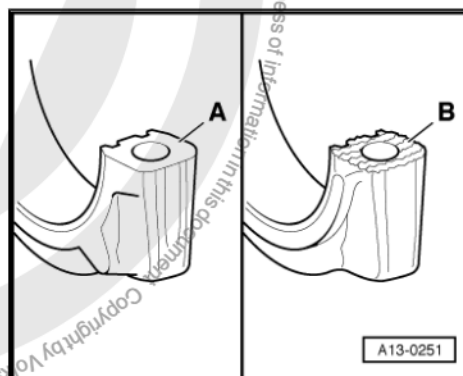
- ☐ Remove and install manually and carefully the 3-part oil scraper rings.
- ☐ "TOP" mark must point towards piston head.
- ☐ Check opening between ends ➔ [page 38](#)
- ☐ Check clearance on the piston channel ➔ [page 39](#)

## 10 - Compression rings

- ☐ Position the apertures in 120°.
- ☐ Remove and install compression rings with compression ring pliers.
- ☐ "TOP" mark points towards the piston head.
- ☐ Check opening between ends ➔ [page 38](#)
- ☐ Check ring clearance in the piston groove ➔ [page 39](#)

## Typical connecting rods

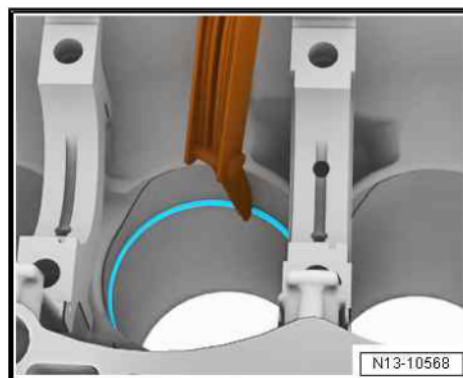
- A- Conventional connecting rods (smooth separation surface).
- B- Broken connecting rods (rough separation surface).



## Openings of piston ring ends - check

- Insert the ring at right angle from top to the cylinder lower opening, with a distance of approx. 15 mm to cylinder edge.

Ring		Opening gap	
		new	wear limit
1st compression ring	mm	0,20...0,35	1,0
2nd compression ring	mm	0,20...0,40	1,0
Oil scraper ring	mm	0,25...0,75	1,0

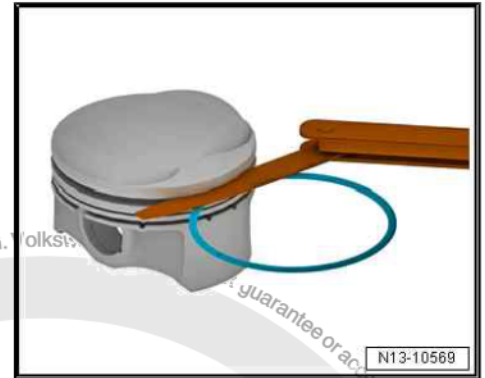




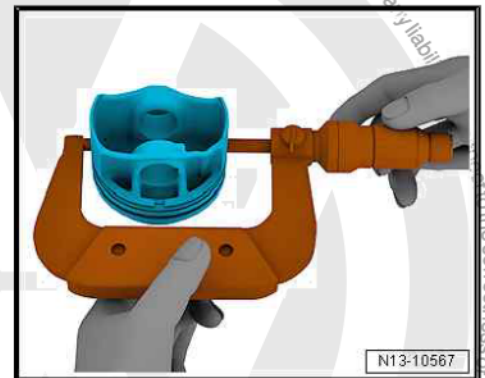
## Check ring clearance in the piston groove

Clean ring groove before test.

Ring		Groove clearance	
		new	wear limit
1st compression ring	m m	0,040...0,080	0,15
2nd compression ring	m m	0,020...0,060	0,15
Oil scraper ring	m m	0,010...0,146	0,20



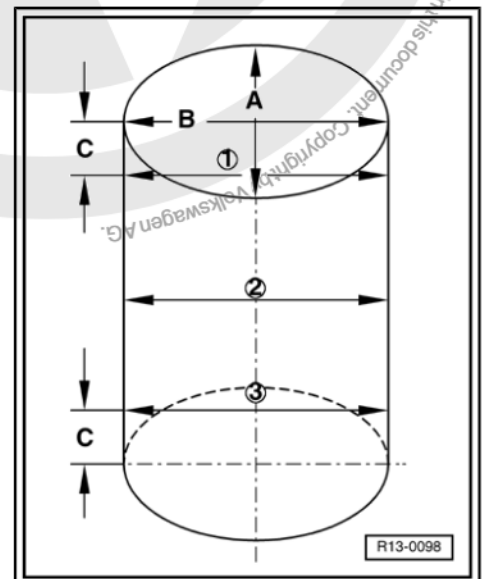
## Piston - check



## Special tools and workshop equipment required

- ◆ External micrometer 60...90 mm
- Measure to approx. 10 mm from lower corner, displaced by 90° in relation to the piston pin axis. Divergence in max. nominal measure 0.07 mm. Nominal measure ➔ [page 40](#) .

## Check cylinder diameters



## Special tools and workshop equipment required

- ◆ Precision internal micrometer 50..0.004 in
- Measure three different places in cross pattern, both transversally -A- and longitudinally -B- at a distance of 10.0 mm from the upper and lower edges -C-. Tolerances in relation to max. nominal measure 0,08 mm ➔ [page 40](#) .



#### Note

*The cylinder diameter should not be measured while the engine block is secured to the assembly stand with the Support - VW 540- or Rotary stand for engine and gearbox - VAS 6095- , because this can produce wrong measures.*

### 4.1 Piston and cylinder specifications

Grinding specifications		Piston-Ø <sup>5)</sup>	Ø cylinder interior
Manufacturer		Mahle	
Basic specification	mm	76,465	76,51
Grinding I	mm	76,715	76,76
Grinding II	mm	76,965	77,01
Grinding III	mm	77,215	77,26

5) The specifications recommendations apply to non-lubricated pistons. Pistons lubricated on measuring point may be greater up to 0.030 mm at Ø, according to the kilometres travelled.



## 15 – Cylinder head, valve gear

### 1 Cylinder head - assembly and disassembly

Check compression ➔ [page 55](#) .



#### WARNING

*Always replace self-locking nuts and screws subject to angular torque*



#### Note

- ◆ *When a replacement cylinder head is assembled, it is necessary to lubricate all contact surfaces between support elements and valve seats, before assembling the cylinder head.*
- ◆ *The plastic shims provided for protecting the open valves should not be removed until immediately before fitting the cylinder head.*
- ◆ *When replacing the cylinder head, all coolant must also be replaced.*







## 1 - 20 Nm 90°

- ☐ Replace after each removal.
- ☐ To loosen and tighten, immobilize the camshaft gear with the Special wrench - 3036-.

## 2 - Camshaft gear

- ☐ Observe fastening during assembly.
- ☐ Check the installation position of toothed belt ⇒ [page 45](#).

## 3 - 10 Nm

- ☐ Apply Liquid sealant - D 000 600 A2-.

## 4 - Rear cover of the mechanical distribution

## 5 - Cylinder head cover

- ☐ Sealing surfaces cannot be ground.
- ☐ With integrated camshaft bearings.
- ☐ Remove any residue of Sealing compound for engines - AMV 188 001 02- or Sealing compound for engines - D 154 103 A1- before positioning.
- ☐ Apply Sealant compound for engines - AMV 188 001 02- or Sealant compound for engines - D 154 103 A1- before positioning.

- ☐ For assembly, place in vertical position from top with the pins in the cylinder head holes.
- ☐ Disassembly and assembly ⇒ [page 64](#).

## 6 - Engine cylinder head screw

- ☐ Replace.
- ☐ Observe assembly and sequence instructions when loosening and tightening ⇒ [page 50](#).

## 7 - Protector

- ☐ Check assembly position.

## 8 - Oil reservoir lid

- ☐ Replace the seal, if damaged.

## 9 - Finishing

- ☐ Replace if damaged.

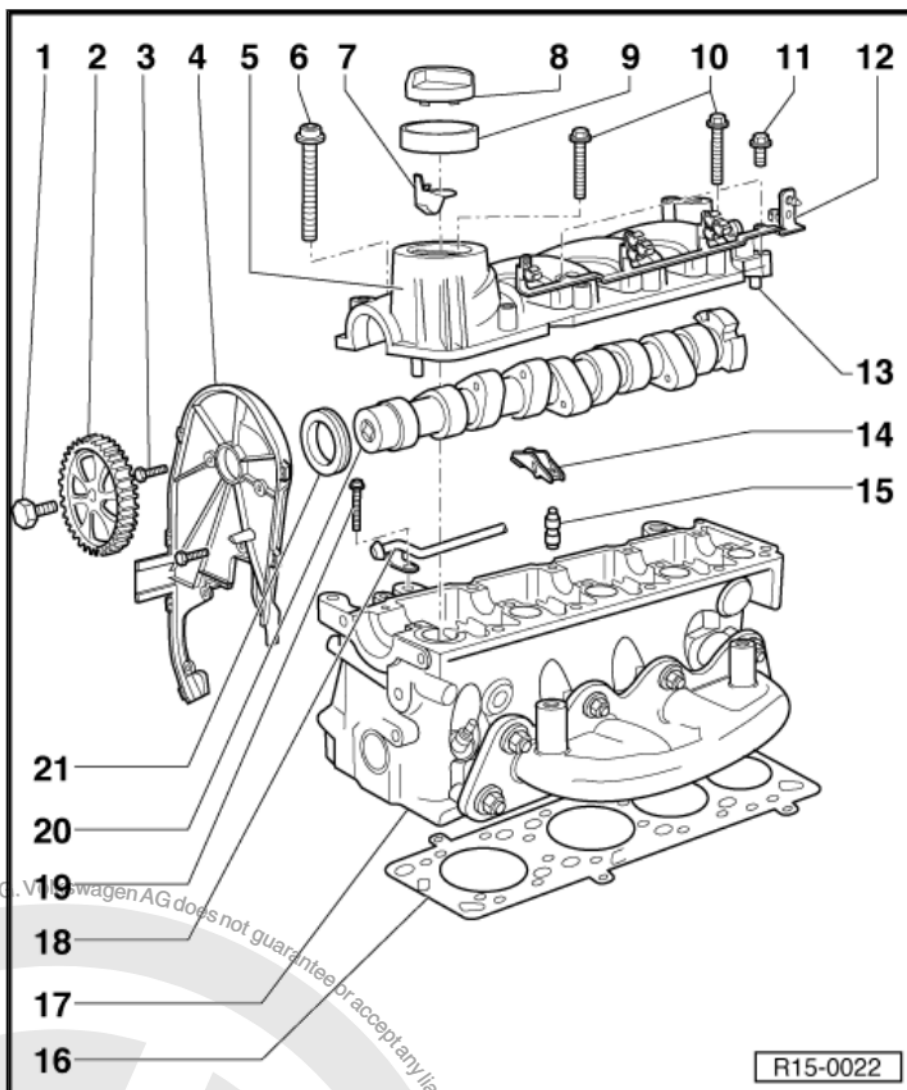
## 10 - 6 Nm 90°

- ☐ Replace after each removal.
- ☐ Observe installation and sequence instructions when loosening and tightening ⇒ [page 64](#).

## 11 - 10 Nm

## 12 - Support

- ☐ For ignition cables.







### 13 - Guide pin

### 14 - Roller rockers

- ☐ Check the roller bearing.
- ☐ Lubricate the surface of the roller bearing with oil.
- ☐ For installation, fit the safety clip to the support element.
- ☐ Supplier "INA" with "030" engraving on the side near the spherical region.
- ☐ Supplier "GTT" with "S3011" engraving on the side near the spherical region.
- ☐ Do not mix, as in a single head only parts from the same supplier may be installed.

### 15 - Support element

- ☐ Do not change the working position.
- ☐ With valve clearance hydraulic offsetting.
- ☐ Lubricate the contact surface with oil.
- ☐ Supplier "INA" with "I" engraving on the bottom of the support element.
- ☐ Supplier "GTT" with "GT" engraving on the bottom of the support element.
- ☐ Do not mix, as in a single head only parts from the same supplier may be installed.

### 16 - Cylinder head sealing gasket

- ☐ Metal gasket.
- ☐ Replace.
- ☐ After replacing, replace coolant.

### 17 - Engine cylinder head

- ☐ The sealing surface on the camshaft side must not be ground.
- ☐ Check warping ⇒ [page 43](#)
- ☐ After replacing, replace coolant.
- ☐ Disassembly and assembly ⇒ [page 58](#) .

### 18 - Lines

### 19 - 20 Nm

### 20 - Camshaft

- ☐ Camshaft repair ⇒ [page 58](#) .
- ☐ Removal and installation ⇒ [page 64](#) .

### 21 - Camshaft seal

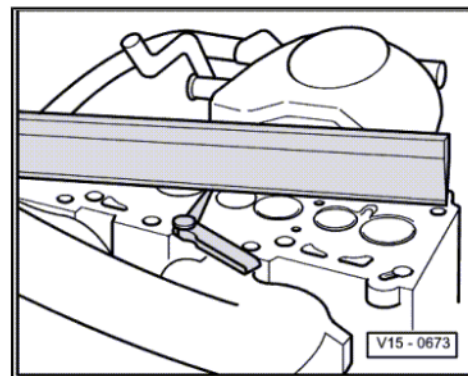
- ☐ Slightly lubricate the seal lip with oil.
- ☐ Replace ⇒ [page 62](#) .

Check for warping of the cylinder head



Note

Maximum warping allowed: 0.05 mm.



## 1.1 Toothed belt semi-automatic tensioning pulley - check

Special tools and workshop equipment required



- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2") - VAG 1331-



#### Test sequence

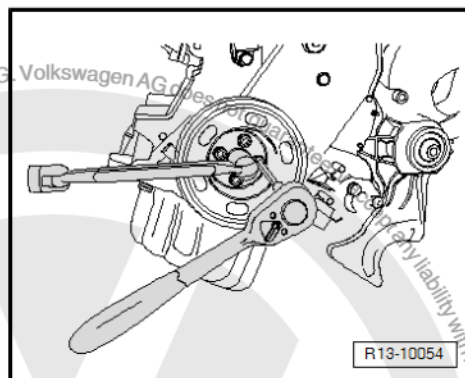
- Remove air filter body ⇒ [page 132](#)
- Remove lower noise insulation from engine compartment: ⇒ Body - Repair; Rep. gr. 50 ; Body - Front part .
- Remove right front wheel case cover: ⇒ General body repairs, exterior; Rep. gr. 66 ; External equipment .
- Mark the Poly-V belt operating direction and remove it ⇒ [page 18](#) .
- Remove the heat deflector from the exhaust manifold.

#### Vehicles with air conditioning

- Remove the tensioning pulley from the Poly-V belt.

#### Continuation for all vehicles

- Remove crankshaft pulley.
- Remove mechanical distribution lower and upper covers.
- Turn crankshaft twice in the engine rotation direction until it is in cylinder 1 TDC.





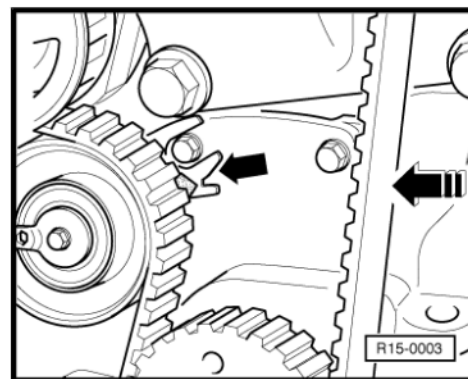
- Memorize the position of the belt tensioning indicator arm -arrow-. Press the timing belt hard with thumb. The indicator arm should move.
- Loosen the drive belt once again.
- Turn the crankshaft twice in the direction that the engine turns.
- Check the position of the indicator arm. It must return to the original position.

If the indicator does not return to its original position:

- Replace the belt tensioning.

If the belt tensioning is correct:

- Install the lower and upper covers of the mechanical distribution.
- Install the crankshaft pulley (check the fastening). Tightening torque: 15 Nm + 40°.



Vehicles with air conditioning

- Install Poly-V belt tensioning element. Tightening torque:

- ◆ M8 = 25 Nm
- ◆ M10 = 45 Nm

Continuation for all vehicles

- Install exhaust manifold heat baffle. Tightening torque: 10 Nm.
- Install Poly-V belt ⇒ [page 18](#).



Note

*While installing the Poly-V belt, carefully observe the proper seating of the belt on the pulley.*

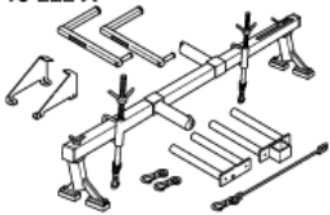


- Install the right front wheel case cover: ⇒ General body repairs, exterior; Rep. gr. 66 ; External equipment .
- Install engine compartment lower noise insulation: ⇒ Body – Repair; Rep. gr. 50 ; Body - Front part .
- Install air filter body ⇒ [page 132](#)

## 1.2 Toothed belt - remove and install, adjust



#### Special tools and workshop equipment required

- ◆ Support device - 10-222A-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Torque meter - 40 to 200 Nm (enc. 1/2") - VAG 1332-

<p><b>10-222 A</b></p> 	<p><b>V.A.G 1331</b></p> 
<p><b>V.A.G 1332</b></p> 	
<p>Protected by copyright. Copyright by Volkswagen AG. Volkswagen AG does not guarantee or accept any liability with respect to the correctness of information in this document.</p>	

W13-0115

#### No illustration:

- ◆ Lifting eyelets, replacement part number: Lifting tackle - 030.103.390.F- (pulley side), Lifting tackle - 030.103.390.G- (flywheel side).
- ◆ Torque meter - 40 to 200 Nm (enc. 1/2") - VAG 1332-
- ◆ -Chave sextavada-  
(Adjust command times)

### 1.2.1 Removal

- Remove air filter body ⇒ [page 132](#)
- Remove right front wheel case cover ⇒ General body repairs, exterior; Rep. gr. 66 ; External equipment .
- Mark the position of the turning direction of the Poly-V belt and remove it ⇒ [page 18](#) .
- Remove the heat deflector from the exhaust manifold.

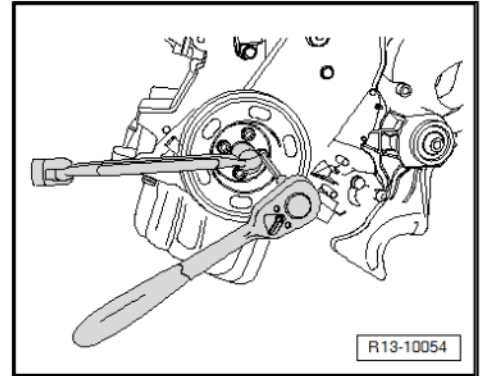
#### Vehicles with air conditioning

- Remove the tensioning pulley from the Poly-V belt.

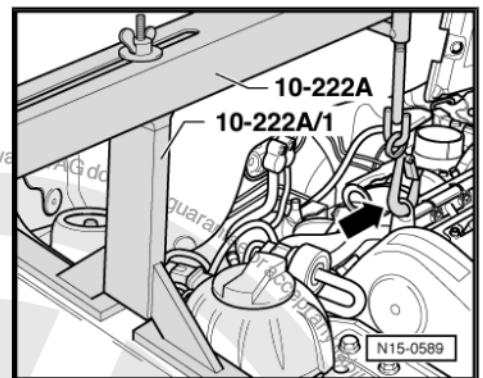


#### Continuation for all vehicles

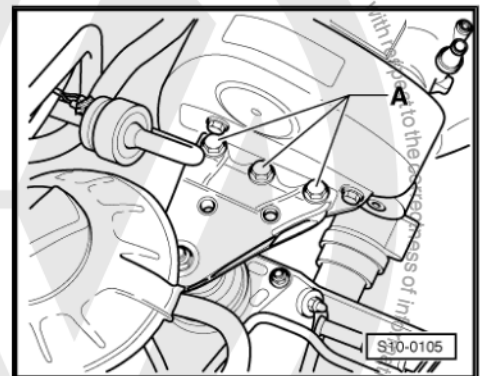
- Remove upper cover from mechanical distributor.
- Remove crankshaft pulley.
- Remove lower cover to mechanical distributor.
- Disconnect cooling system lines from the engine cylinder head.
- Screw lifting eyelets in the place of the cylinder head cooling system pipes. Tightening torque: 25 Nm.



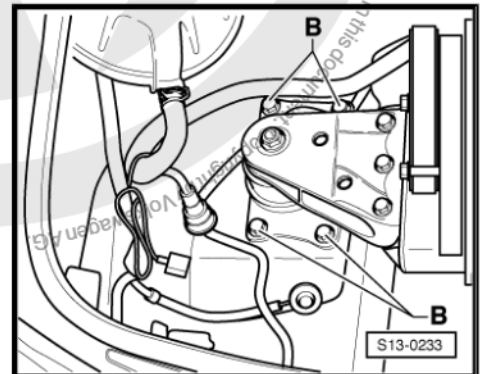
- Place the Support or 10-222A - VW 061- as illustrated and support the engine in the assembly position.
- Remove coolant reservoir (hoses remain connected).



- Secure the engine a little and loosen fastening screws -A-.



- Loosen fastening screws -B- and also the support of the power-drive group, complete engine.
- Remove the support of the power-drive group, engine on the engine block.
- Mark the operation direction of the toothed belt.
- Loosen the belt tightener and remove the toothed belt.



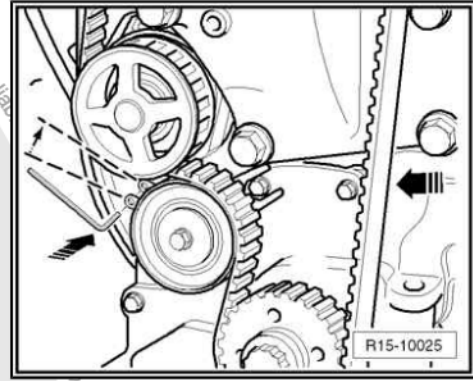
#### 1.2.2 Tensioning element without adjustment

- Press the toothed belt in the direction of the -arrow-, on the right side.





- With the bearings aligned, install the lock pin (Allen 2.5 mm).
- Remove the tensioning element.
- Remove the toothed belt and mark the direction of rotation.



### 1.2.3 Installation

#### Conditions

- The engine must be warm, at most.
- The pistons cannot be in the TDC.

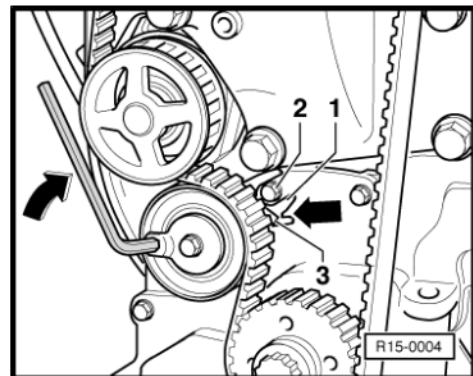
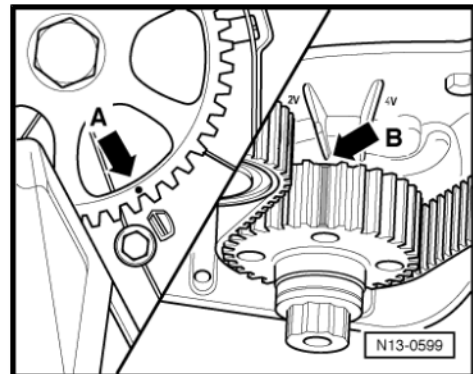


#### Note

*When turning the camshaft, the valves may hit the pistons located in the TDC.*

#### Operation sequence

- Place the camshaft gear onto the mark -arrow A-.
  - Place the crankshaft in the TDC of cylinder 1. The tooth marked on the camshaft gear must match the mark "2V" on the flange/oil pump -arrow B-.
  - Install the toothed belt. Check operating direction on used timing belts.
- 
- Manually tighten the fastening screw of the belt tensioning element. The base plate notch -1- must reach over the fastening screw -2-.
  - Stretch the timing belt by turning the belt tensioning element in the arrow direction until the indicator -3- reaches the mark on the base plate -arrow-.
  - Tighten the belt tensioning element fastening screw. Tightening torque: 25 Nm.
  - Now turn crankshaft twice in the direction the engine turns until it is in the TDC of cylinder 1 again.
  - Then, check again the adjustment of the toothed belt and the position of the belt tensioning element.

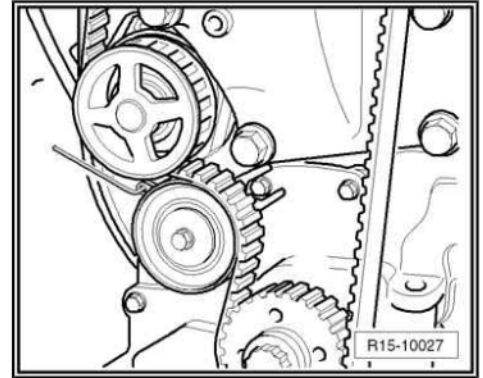


### 1.2.4 Tensioning element without adjustment

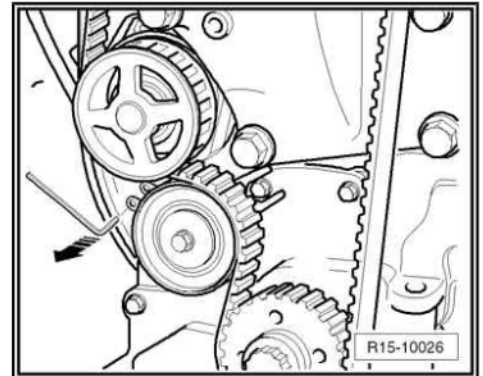
- Install the toothed belt on the camshaft and the water pump gear.



- Install the tensioning element with the lock pin (Allen 2.5 mm) installed.
- Apply 25 Nm of torque to the fastening screw.
- Install the belt on the crankshaft gear.



- Remove the lock pin (Allen 2.5 mm) from the tensioning element.
- Turn the crankshaft twice in the direction of engine rotation until reaching top dead centre for cylinder 1.
- Then, check gear positions again.







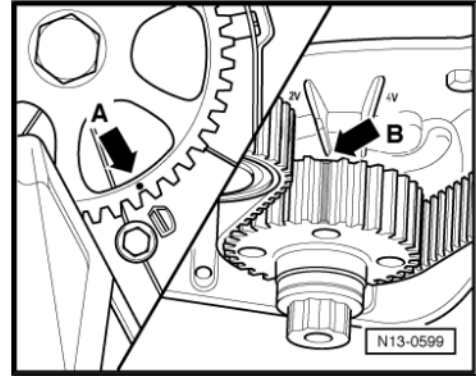
- If necessary, repeat adjustment of the toothed belt.
- Install engine right support on the engine block. Tightening torque: 50 Nm.
- Install the lower cover of the mechanical distribution.
- Install the crankshaft pulley (check the fastening). Tightening torque: 15 Nm + 40°.

#### Vehicles with air conditioning

- Install Poly-V belt tensioning pulley. Tightening torque:
  - ♦ M 8 = 25 Nm
  - ♦ M 10 = 45 Nm

#### Continuation for all vehicles

- Install exhaust manifold heat baffle. Tightening torque: 10 Nm.
- Install the engine subframe. Tightening torque ⇒ [page 11](#) .
- Install the upper cover of the mechanical distribution.
- Install Poly-V belt ⇒ [page 18](#) .



#### Note

*While installing the Poly-V belt, carefully check the proper seating of the belt on the pulley.*

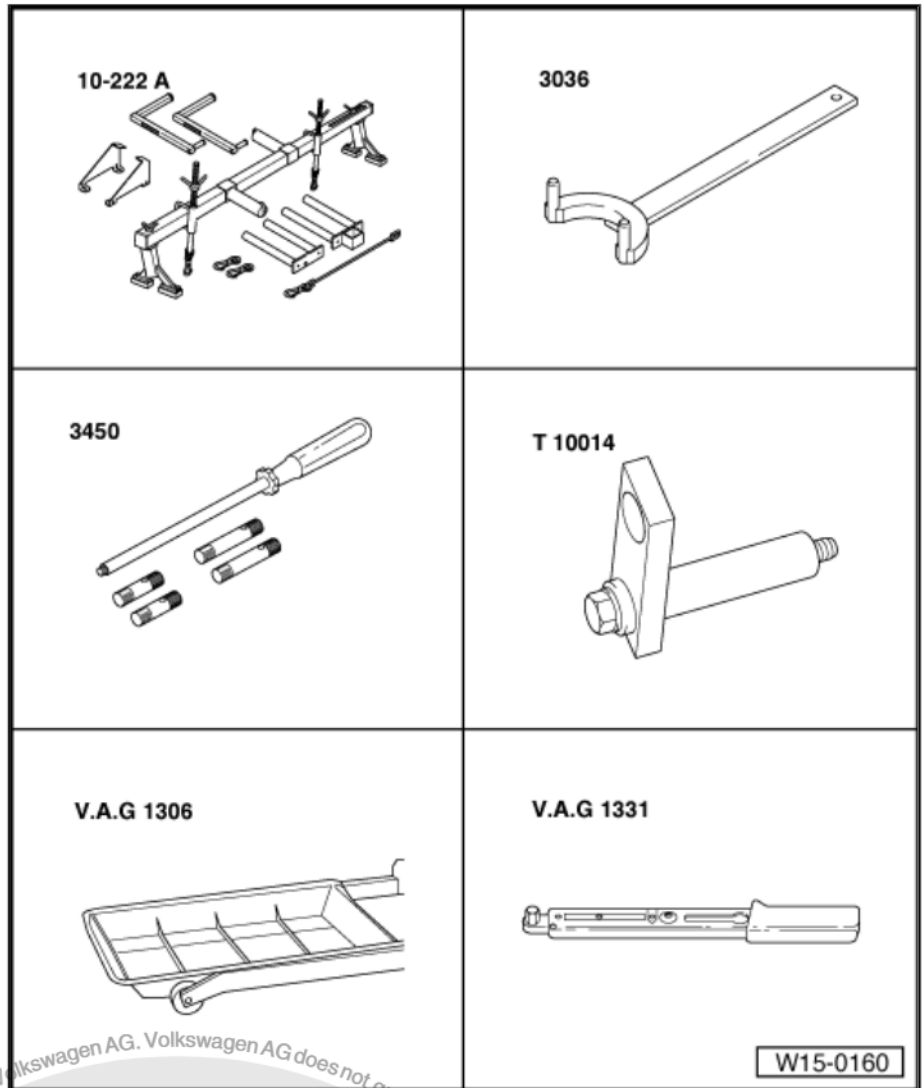
- Install the right front wheel case cover. ⇒ [General body repairs, exterior; Rep. gr. 66](#) ; [External equipment](#) .
- Install engine compartment lower noise insulation.
- Install coolant reservoir.
- Remove lifting eyelet from engine cylinder head.
- Install the cooling system piping to the engine cylinder head. Tightening torque: 25 Nm.
- Install air filter body ⇒ [page 132](#)

### 1.3 Cylinder head - remove and install

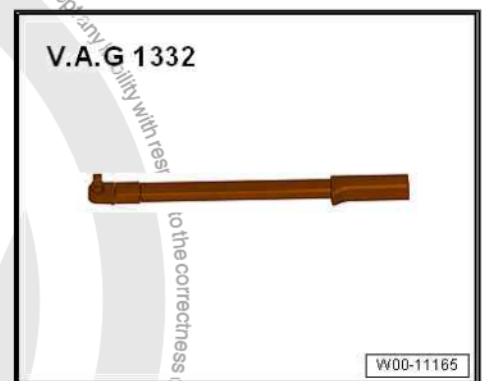


# Special tools and workshop equipment required

- ◆ Support device - 10-222A-
- ◆ Special wrench - 3036-
- ◆ Guides - 3450-
- ◆ Support - T10014-
- ◆ Oil trap - VAG 1306-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-



No illustration:

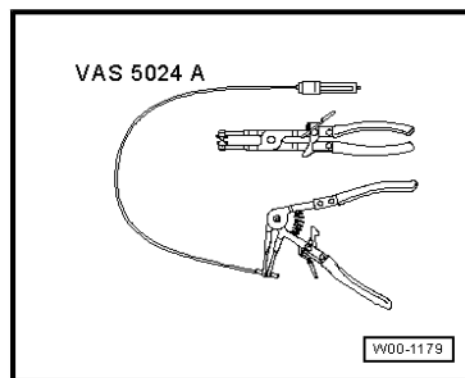




- ♦ Lifting eyelets, replacement part number: Lifting tackle - 030.103.390.F- (pulley side), Lifting tackle - 030.103.390.G- (flywheel side).
- ♦ Torque meter - 40 to 200 Nm ( enc. 1/2") - VAG 1332-
- ♦ VAS 5024A or Standard-type clamp pliers - VW 5162-

Initial conditions

- Engine warm, at most.



### 1.3.1 Removal



#### Note

*In order to perform these tasks, it is necessary to disconnect the Battery earth strap. To do so, check if the vehicle has a coded radio. if so, request the respective anti-theft code.*

- With the ignition switched off, disconnect battery earth strap.
- Remove air filter body ⇒ [page 132](#)
- Disconnect cooling system lines from the engine cylinder head.
- Screw lifting eyelets in the place of the cylinder head cooling system pipes. Tightening torque: 25 Nm.
- Loosen right front wheel case cover ⇒ General body repairs, external; Rep. gr. 66 ; External equipment .
- Remove toothed belt ⇒ [page 45](#) .
- Remove camshaft gear to loosen the screw and immobilize the camshaft gear with the Special wrench - 3036- .

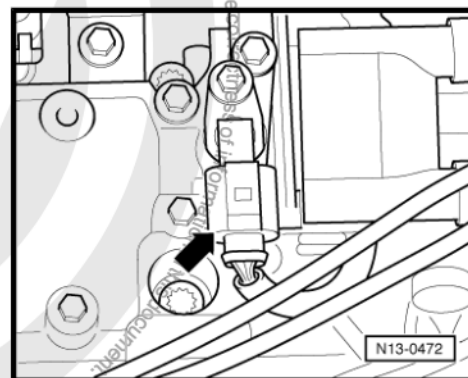
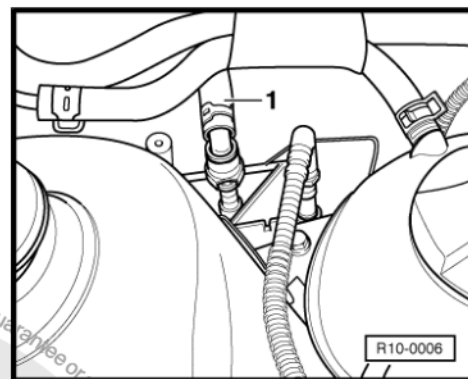


#### WARNING

*Fuel supply hose is under pressure. Before loosening hose connection points, place a cloth around it. Next, eliminate pressure by carefully removing hose.*



- Disconnect the fuel supply pipes -1- (press the unlock key).
- Loosen the hose for the Magnetic valve I for activated charcoal filter - N80- -1- on the intake manifold.
- Close the pipes so as to avoid any dirt from coming into the supply system.
- Disconnect or loosen the following components:
  - ◆ intake manifold vacuum hose for the brake servo.
  - ◆ the fitting connector for the Ignition transformer - N152- and the Throttle valve control unit - J338- .
  - ◆ injection valve connectors.
  - ◆ the connector of the Engine speed sensor - G28- and Intake manifold pressure sensor - G71- / Air intake temperature sensor - G42- .
  - ◆ the double-sided connector for the Knock sensor 1 - G61- (behind the block ).
  - ◆ the connector for the Coolant temperature sensor - G62- and Oil pressure switch - F1- .
- Disconnect the 3-pole connector for the Sensor Hall - G40- -arrow-.
- Remove the fuel distributor with all its injectors in its entirety ⇒ [page 131](#) .
- Open and close the coolant tank cap to depressurize the cooling system once more.
- Drain cooling system ⇒ [page 90](#) .
- Remove the water pump together with the mechanical distribution rear cover ⇒ [page 100](#) .
- Remove the clip on the cooling system thermostat valve body, which holds the cooling system tube on the pump.
- Remove the thermostat valve body from the engine cylinder head.
- Disconnect all connection hoses, cooling system, vacuum and suction hoses from the engine cylinder head.
- Disconnect exhaust tube from the exhaust manifold ⇒ [page 148](#) .
- Loosen the oil dipstick guide tube from intake manifold.





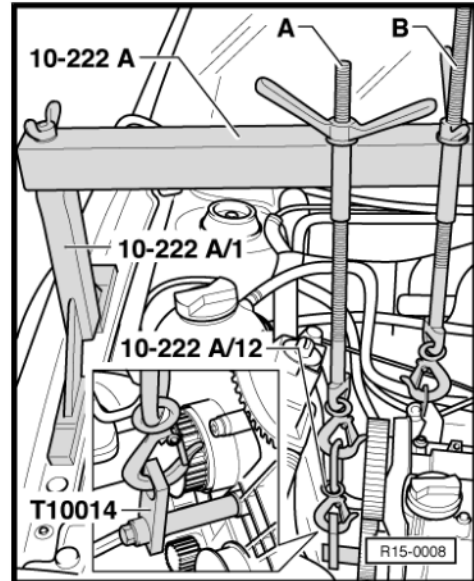
- Then, raise the engine a little bit with the threaded part -B- .



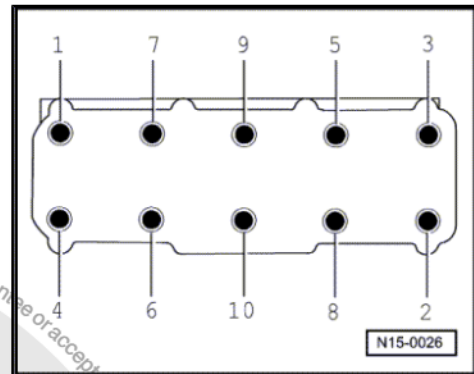
#### Note

*Since the lifting eyelet is screwed to the engine cylinder head, an additional support must be secured to the engine block to support the engine.*

- Screw, as indicated, the Lock - T10109- into the threaded hole in the water pump area of the cooling system on the engine block. Tightening torque: 20 Nm.
- Slightly raise the engine with the second threaded part -A- until the threaded part -B- is relieved.
- Remove threaded part -B-.



- Loosen the engine cylinder head screws in the indicated sequence and remove them.
- Raise the engine cylinder head carefully.



### 1.3.2 Installation



#### Note

- ♦ *Remove the new engine cylinder head sealing gasket from the package immediately before installation only.*
- ♦ *Handle the new gasket as carefully as possible. Damage may cause leaks.*
- Put a clean cloth on the cylinder so as to prevent any dirt or sandpaper residues from getting in between the cylinders and the pistons.
- Also prevent dirt and sandpaper residues from getting into the cooling system.
- Carefully clean engine cylinder head and engine block sealing surfaces. Make sure that no longitudinal scrapes or scratches are produced in this operation (when using sandpaper, the grain should never be lower than 100).
- Carefully remove sandpaper residues with a cleaning cloth.
- Place the cylinder 1 piston in TDC and turn the crankshaft slightly backwards.





- To centralize the engine head, screw the Guides - 3450- into the external rear holes of engine cylinder head screws -arrows-.
- Place the new cylinder head sealing gasket onto the centring pins -A-. The inscription (spare part number) must be legible.
- Install engine cylinder head and the 8 remaining cylinder head screws and tighten manually.
- Loosen the Guides - 3450- with the Extractor - 3450/3- through the screw holes. Turn the Extractor - 3450/3- to the left until the guides are loose.
- Insert the two remaining cylinder head screws and tighten them manually.
- Tighten the cylinder head screws in the indicated tightening sequence, as follows:
- First, tighten all fastening bolts to a tightening torque of 30 Nm.
- Next, apply a 180° angle torque to the bolts, using a hard spanner.

**Note**

*There is no need to tighten the engine cylinder head screws again after the repairs.*

Continue installation in the reverse sequence to the removal.

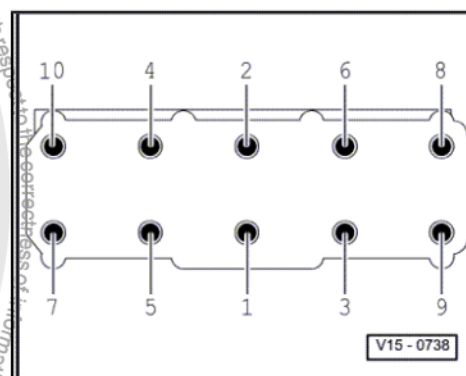
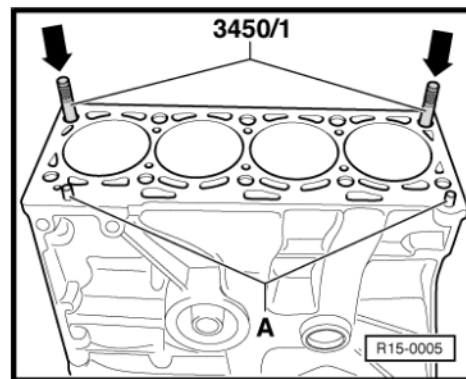
**Note**

*When turning the camshaft, the crankshaft cannot be in TDC.  
Risk of damage to the piston head/valves.*

Installing the toothed belt and adjusting the command times  
⇒ [page 45](#) .

Replenish cooling system ⇒ [page 90](#) .

- Consult the event memory ⇒ [page 144](#) .

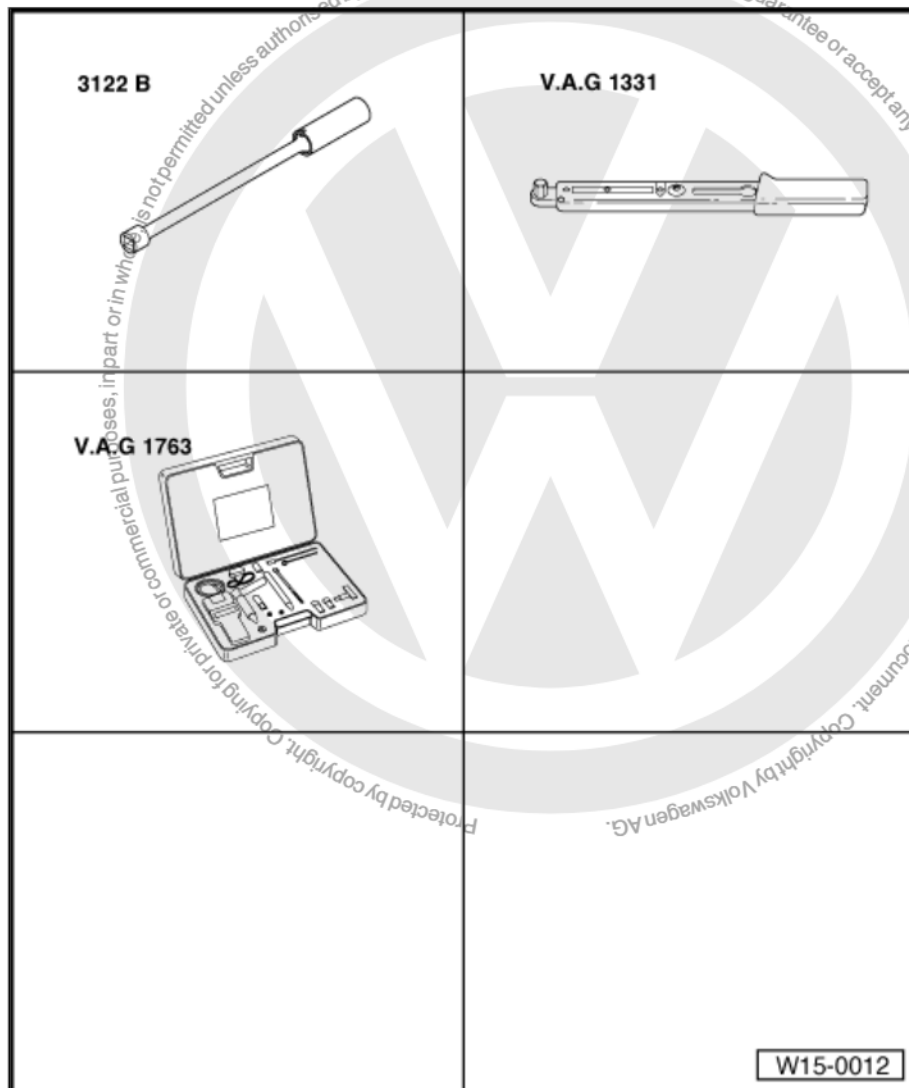


## 1.4 Compression - check



#### Special tools and workshop equipment required

- ◆ Spark plug wrench - 3122B-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Cylinder compression gauge - petrol/ethanol - VAG 1763-



#### Test conditions

- The engine oil temperature must be at least 30°C.
- Voltage of Battery must be at least 11.5 volts.
- All electrical components, such as lights and rear window, must be turned off.
- If the vehicle is equipped with air conditioning, turn it off.

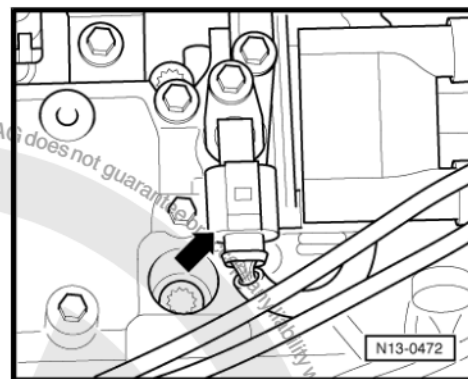
#### 1.4.1 Checking

- Remove air filter body ⇒ [page 132](#)
- Remove the spark plugs with the Spark plug wrench - 3122B- .

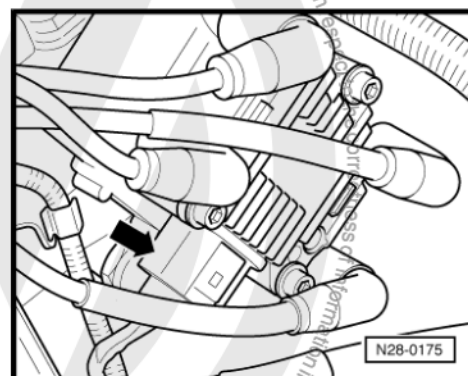




- Disconnect the 3-pole connector for the Sensor Hall - G40-  
-arrow-.



- Disconnect the 4-pole connector from the Ignition transformer  
- N152- -arrow-.



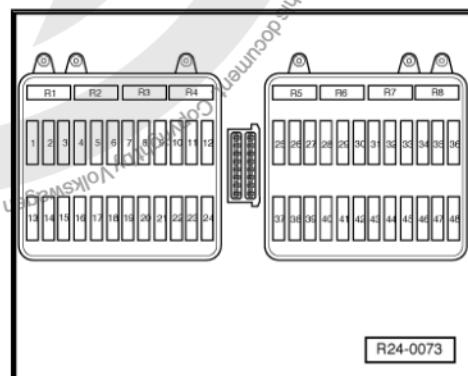
- Remove fuse 44 from fuse box.



#### Note

Removing fuse 44 interrupts the power supply to the injectors.

- Request another mechanic to step on the accelerator pedal, in such a way that the accelerator valve (butterfly) is completely open.
- Check compression with a Cylinder compression gauge - gasoline - VAG 1763- or -VAG 1381- .



#### Note

The testing device operation is described in the respective operation instructions.

- Operate the starter motor until there is no more increase in the pressure of the testing device.

#### Compression values

Engine prefix		BKR
Cylinder compression	bar	15.17 to 17.93
Wear limit	bar	10,62
Maximum compression difference between cylinders	bar	3,00

- Screw the spark plugs using a Spark plug wrench - 3122B- and tighten to a torque of 30 Nm.
- Check event memory, eliminate possible present failures and, then, erase event memory ➤ [page 144](#) .



## 2 Valve command - repair



### WARNING

*Always replace self-locking nuts and screws subject to angular torque*



### Note

- ◆ *Cylinder heads with cracks between the valve seats or between a valve seat and Spark plug - Q- threads can still be used without reducing the useful life, provided that such cracks are small, maximum 0,5 mm wide or when only the first Spark plug - Q- threads have cracks.*
- ◆ *Lubricate all supporting and sliding surfaces prior assembly.*
- ◆ *Use Plate - VW 5541/3- to fasten the head and valve support.*

#### 1 - Camshaft

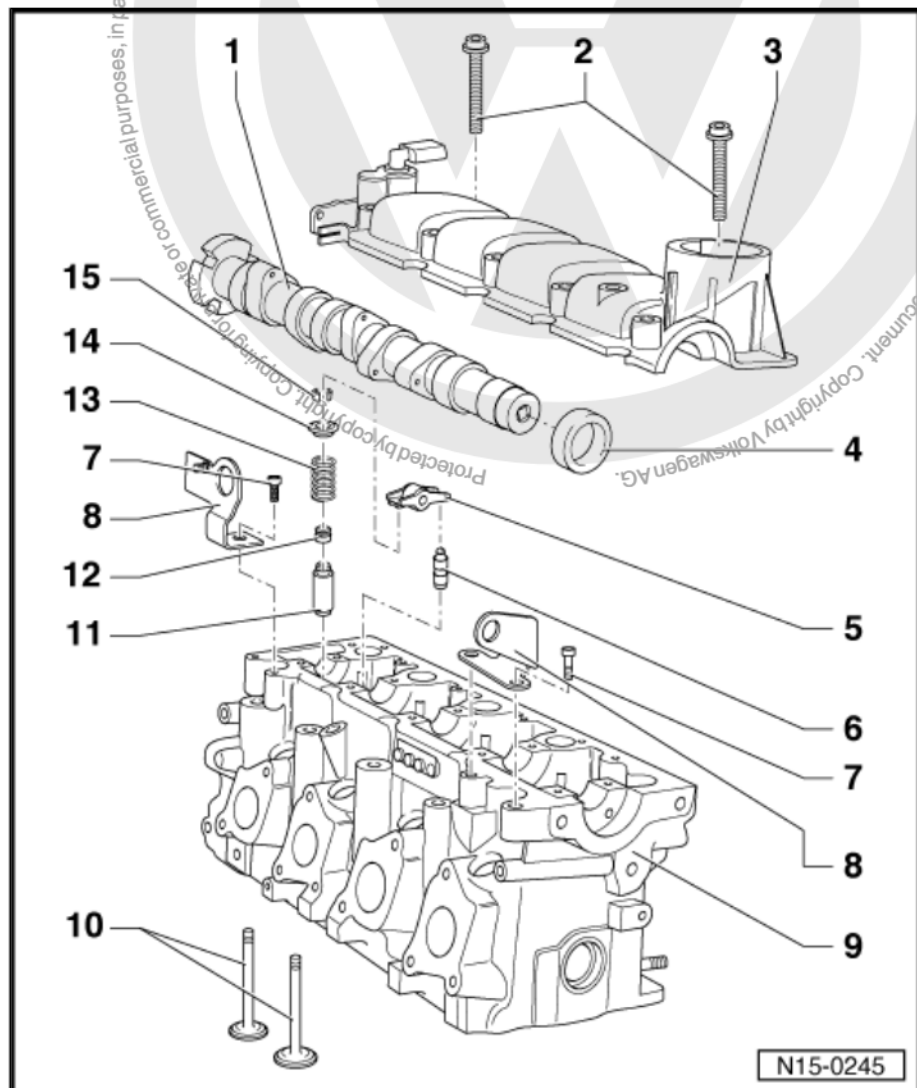
- ☐ Check axial clearance  
⇒ [page 60](#) .
- ☐ Removal and installation ⇒ [page 64](#) .
- ☐ Check radial clearance with Plastigage, Wear limit of 0.1 mm.
- ☐ Eccentricity: max. 0.05 mm.
- ☐ Code ⇒ [page 60](#)

#### 2 - 6 Nm 90°

- ☐ Replace after each removal.
- ☐ Observe installation and sequence instructions when loosening and tightening ⇒ [page 64](#) .

#### 3 - Cylinder head cover

- ☐ The sealing surface must not be ground.
- ☐ With integrated camshaft bearings.
- ☐ Remove any residue of Sealing compound for engines - AMV 188 001 02- or Sealing compound for engines - D 154 103 A1- .
- ☐ Apply Sealant compound for engines - AMV 188 001 02- or Sealant compound for engines - D 154 103 A1- before positioning.
- ☐ For installation, place it vertically on the holes of the cylinder head with guide pins.
- ☐ Remove and install ⇒ [page 64](#) .





## 4 - Seal

- ☐ Quickly lubricate with oil the sealing ring lip.
- ☐ Replace ⇒ [page 62](#) .

## 5 - Roller rockers

- ☐ Check the roller bearing.
- ☐ Lubricate the surface of the roller bearing with oil.
- ☐ For installation, loosen the safety clamp on the support element.
- ☐ Supplier "INA" with "030" engraving on the side near the spherical region.
- ☐ Supplier "GTT" with "S3011" engraving on the side near the spherical region.
- ☐ Do not mix, as in a single head only parts from the same supplier may be installed.

## 6 - Support element

- ☐ Do not confuse.
- ☐ With valve clearance hydraulic offsetting.
- ☐ Lubricate the contact surface with oil.
- ☐ Supplier "INA" with "I" engraving on the bottom of the support element.
- ☐ Supplier "GTT" with "GT" engraving on the bottom of the support element.
- ☐ Do not mix, as in a single head only parts from the same supplier may be installed.

## 7 - 25 Nm

## 8 - Lifting tackle/eyelet

- ☐ Spare part numbers: Lifting tackle - 030.103.390.F- (pulley side), Lifting tackle - 030.103.390.G- (flywheel side).

## 9 - Engine cylinder head

- ☐ The sealing surface on the camshaft side must not be ground.
- ☐ Grind valve seat ⇒ [page 61](#) .
- ☐ Grind sealing surface on the engine block side ⇒ [page 59](#)

## 10 - Valves

- ☐ Do not grind, only seating is permitted.
- ☐ Valve dimensions ⇒ [page 61](#)

## 11 - Valve guide

- ☐ Check ⇒ [page 67](#) .

## 12 - Valve stem sealant

- ☐ Replace ⇒ [page 68](#) .

## 13 - Valve spring

- ☐ Remove and install ⇒ [page 62](#) .

## 14 - Spring dish

## 15 - Keys

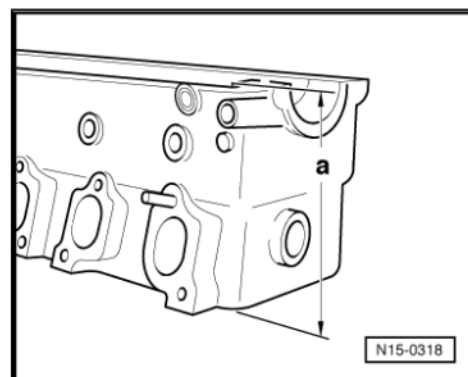
Grind sealing surface on the engine block side

Engine cylinder head grinding measurement: -a- = minimum of 135.6 mm.



Note

*When grinding the surface, valve seats must be ground with the same measure; otherwise, the valves would hit the pistons. Observe the minimum elevation permitted.*





## 2.1 Camshaft - check axial clearance

Special tools and workshop equipment required

◆ Support - VW 387-

◆ Dial gauge - VAS 6079-

– Camshaft - check axial clearance.

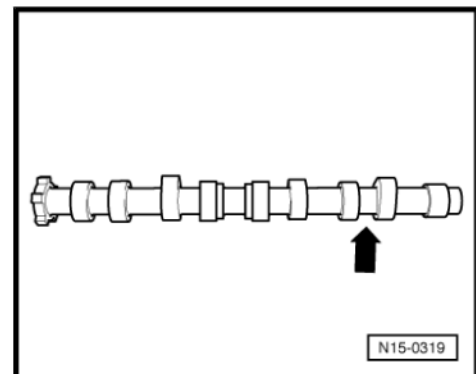
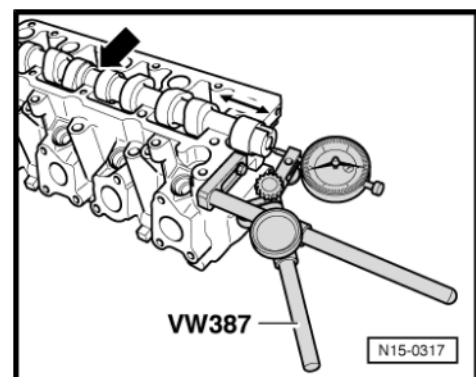
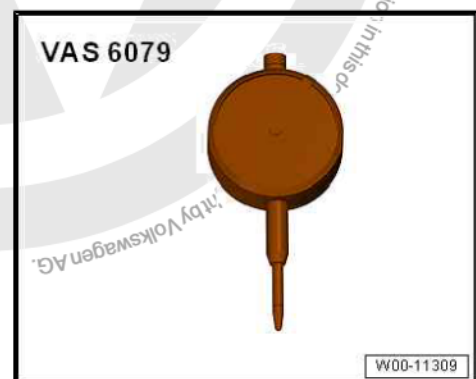
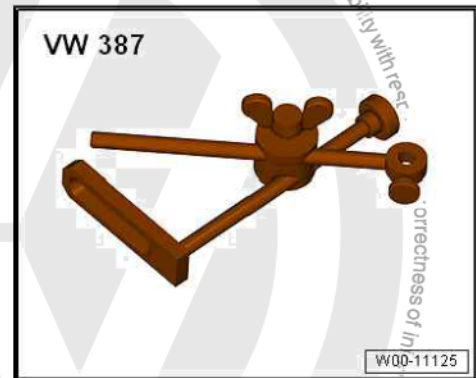
Measure with support elements and camshaft cover removed.

– Press camshaft on the central bearing -arrow-, and check axial clearance moving the camshaft.

Wear limit: max. 0.15 mm.

Crankshaft codes

Code between intake and exhaust cams of cylinder 1	
Cylinder 1 -arrow-	030 CG





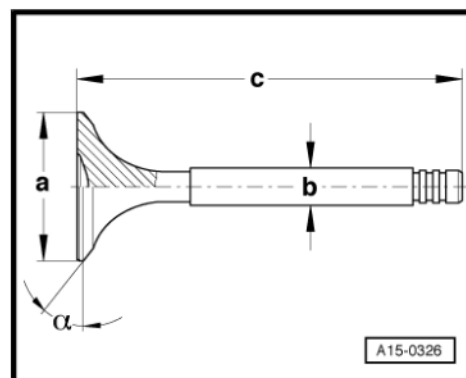
## Valve dimensions



### Note

Valves cannot be ground. Only seating is permitted.

Dimensions		Intake valve	Exhaust valve
Ø a	mm	34,5	28,0
Ø b	mm	5,98	5,96
c	mm	99,25	99,25
α	°	45	45



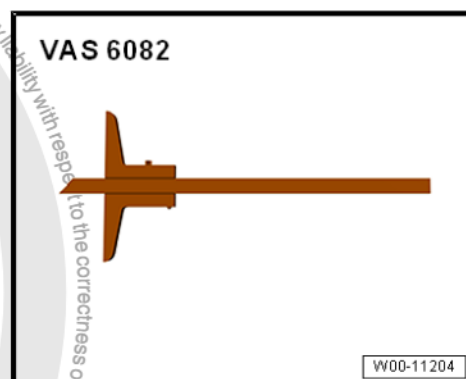
## 2.1.1 Distribution times for 1-mm valve clearance

		Intake valve	Exhaust valve
Opens after	TDC	1,0°	-----
Closes after	BDC	26,0°	-----
It opens before	BDC	-----	38,0°
Closes before	TDC	-----	13,0°

## 2.2 Valve seat - trim

Special tools and workshop equipment required

- ◆ Depth gauge - VAS 6082-



- ◆ -Retificadora de sede das válvulas-



### Note

- ◆ In case of repairs on engines with leaking valves, simply grinding or replacing the seats and valves is not enough. The valve guides must also be checked for wear, especially in engines with high mileage. ➔ [page 67](#).
- ◆ Grind the valve seat only until a correct image is presented. Calculate the maximum grinding prior to grinding. When the grinding measurement is exceeded, the hydraulic offsetting is no longer guaranteed, and the engine cylinder head must be replaced.

## 2.2.1 Calculating maximum trim

- Install valve and firmly press it against the valve seat.





#### Note

*If the valve is replaced during repairs, use a new valve to measure.*

- Measure the distance -a- between valve end and the upper edge of the engine cylinder head.
- Calculate maximum and minimum grinding measurements of the measured distance.

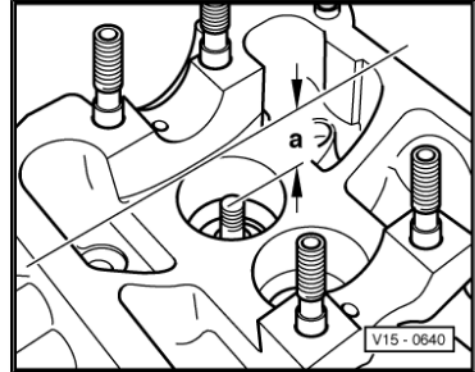
Minimum measurements: Intake valve and exhaust valve 32.1 mm.

Measured distance minus minimum distance = Maximum grinding measurement allowed.

For example:

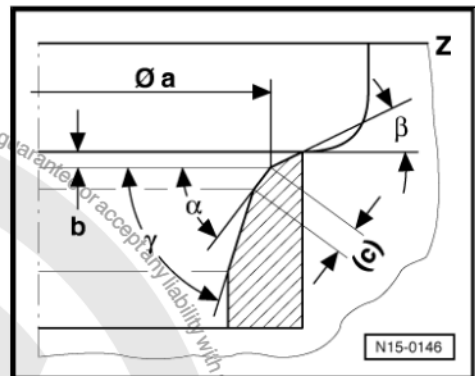
- Measured distance	32,5 mm
Minimum specification:	32,1 mm
= Max. grinding specification allowed <sup>6)</sup>	0,4 mm

6) The max. grinding measurement allowed is shown in the illustrations to grind the valve seats as per measurement "b".



### 2.2.2 Grind intake valve seat

- a =  $\varnothing 32.9$  mm
- b = maximum trimming dimensions admissible
- c = max. 1.8 ...2.0 mm
- Z = Lower cylinder head edge
- $\alpha$  = 45° Valve seat angle
- $\beta$  = 30° Upper correction angle
- $\gamma$  = 60° Lower correction angle

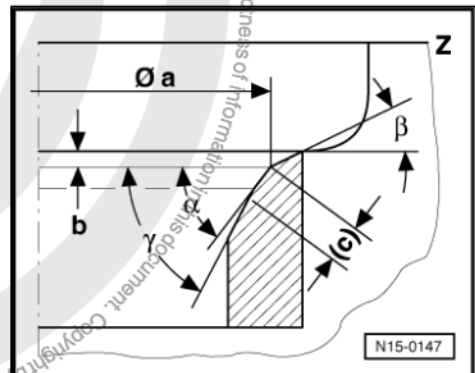


#### Note

*Valve seating rings (seats) may undergo grinding, provided the operation does not damage them.*

### 2.2.3 Grind exhaust valve seat

- a =  $\varnothing 26.6$  mm
- b = maximum trimming dimensions admissible
- c = max. 1.8 ...2.0 mm
- Z = Lower cylinder head edge
- $\alpha$  = 45° Valve seat angle
- $\beta$  = 30° Upper correction angle
- $\gamma$  = 60° Lower correction angle



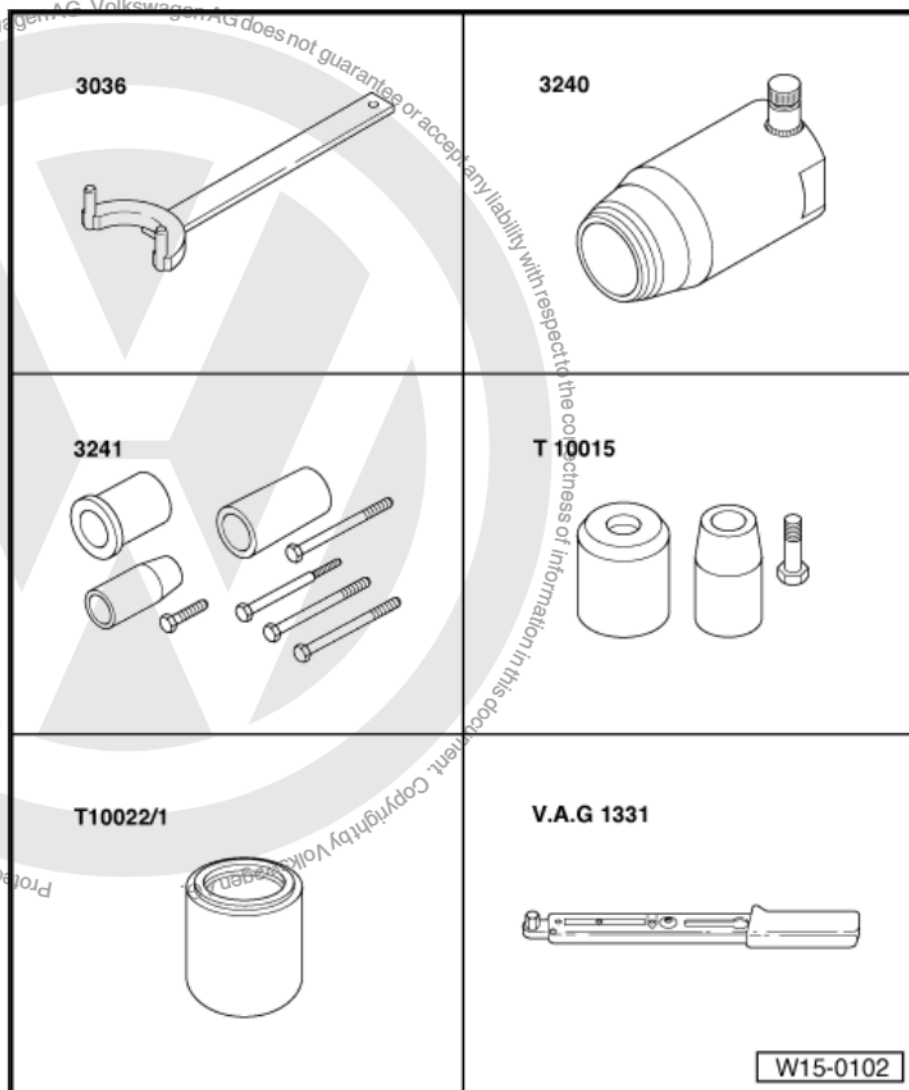
### 2.3 Camshaft seal - replace





### Special tools and workshop equipment required

- ◆ Special wrench - 3036-
- ◆ Puller - 3240-
- ◆ Fitting sleeves - 3241-
- ◆ Fitter - T10015/3-
- ◆ Sleeve - T10022/1-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-

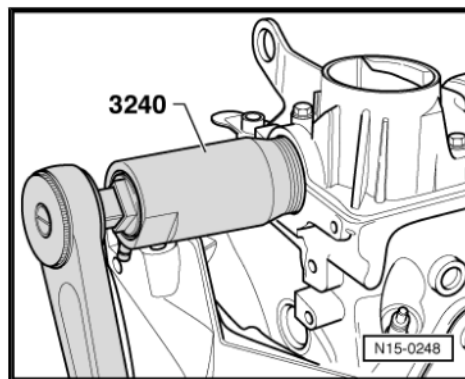


### 2.3.1 Removal

- Remove toothed belt ➔ [page 45](#) .
- Remove the camshaft gear. To loosen the screw, immobilize the camshaft gear with a Special wrench - 3036- .
- Remove the rear cover of the mechanical distribution.
- For seal puller guide, install camshaft screw manually up to the stop on the camshaft.
- Turn the inner part of the Extractor - 3240- twice (approx. 3 mm) from the external part, and lock it with the splined screw.

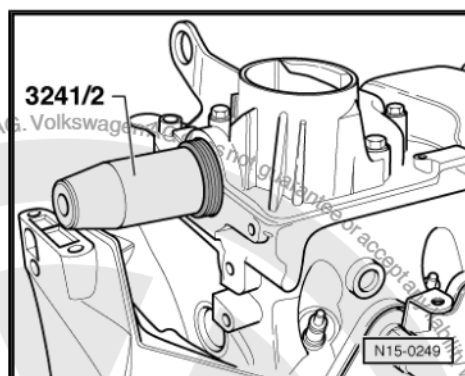


- Lubricate the extractor threaded head, seat it and screw it applying as much force to the seal as possible.
- Loosen the splined screw and turn the inner part against the camshaft until the seal is extracted.
- Loosen the fastening screw used in the camshaft gear.



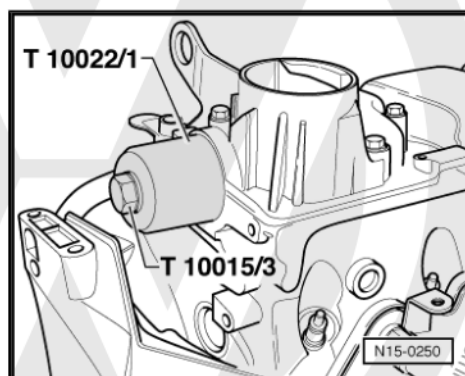
### 2.3.2 Installation

- Quickly lubricate the sealing lip of the seal with oil.
- Install the Fitting sleeves - 3241- on the camshaft trunnion.
- Move the seal through the guide sleeve.
- Remove the guide sleeve.



- Press the seal with the Sleeve - T10022/1- and the Fitter - T10015/3- screw up to the stop. Insert a washer between the pressure sleeve and hex screw.
- Install the camshaft gear and tighten with a new screw (use the Special wrench - 3036- ). Tightening torque: 20 Nm + 90°.
- Continue installation in the reverse sequence to the removal.

Installing the toothed belt and adjusting the command times  
⇒ [page 45](#) .



### 2.4 Camshaft and cylinder head cover - removal and installation

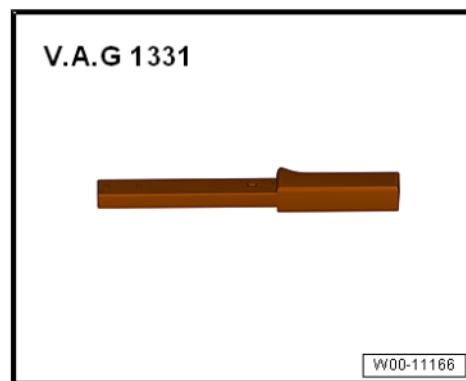
Special tools and workshop equipment required

- ♦ Special wrench - 3036-





- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2") - VAG 1331-



- ◆ Sealing putty for engines - AMV 188 001 02-

## 2.4.1 Removal



### Note

- ◆ *The sealing surfaces on the cylinder head cover and on the engine cylinder head cannot be worked on.*
- ◆ *The camshaft bearings are integrated with the engine cylinder head and its cover. Before removing the cylinder head cover, loosen the toothed belt.*
- ◆ *When loosening the cylinder head cover, replace the camshaft seal.*

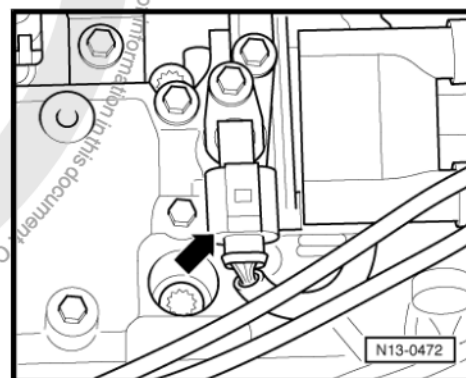
### Operation sequence



### Note

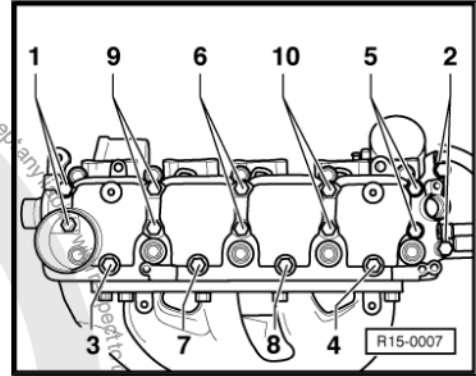
*During the work, disconnect the Battery earth strap. Check whether the vehicle has a coded radio. If so, request the anti-theft code.*

- With the ignition switched off, disconnect battery earth strap.
- Remove toothed belt ➔ [page 45](#) .
- Remove the camshaft gear. To loosen the screw, immobilize the camshaft gear with a Special wrench - 3036- .
- Loosen the three top fastening screws on the rear cover of the mechanical distribution.
- Loosen the Ignition transformer screws from the cylinder head cover.
- Disconnect the 3-pole connector for the Lambda probe - G39-arrow-.
- Remove the oil filler cap from the head cover of the cylinder, loosen and remove the protector.





- Loosen the cylinder head cover screws in the indicated sequence. Screws in position 9- and -position 10- must be loosened alternately in a cross pattern.
- Carefully remove the cylinder head cover.
- Carefully remove the camshaft and place it on a clean surface.
- Remove the rockers together with the support elements and place them on a clean surface.
- Make sure the rockers and support elements are not mixed up.



## 2.4.2 Installation

### Conditions

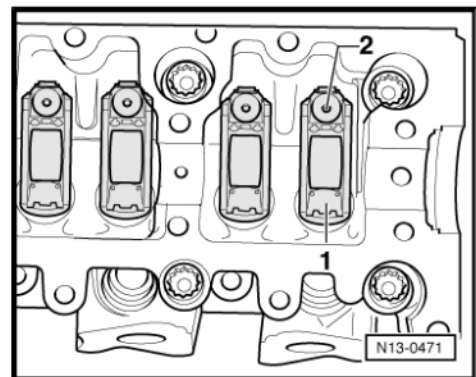
- Prevent dirt and sealant residue from entering the cylinder head of the engine.
- The sealing surfaces must be free of grease and oil.
- The cams in cylinder 1 must be facing upwards when installing the cylinder head cover onto the camshaft.
- The pistons cannot be in the TDC.
- Remove sealant residues in the engine cylinder head and in its cover by using an ordinary sealant remover.
- Lubricate camshaft contact surfaces with oil.



### Note

*For rocker arms and support elements we have 2 suppliers "INA" and "GTT", which can not be installed on the same cylinder head  
⇒ [Item 5 \(page 59\)](#) ⇒ [Item 6 \(page 59\)](#)*

- Install support elements on the engine cylinder head and respective rockers.
- Make sure the rockers are properly positioned on the valve ends -1- and that the respective support elements -2- are properly coupled.
- Carefully install the camshaft on the engine cylinder head bearings.

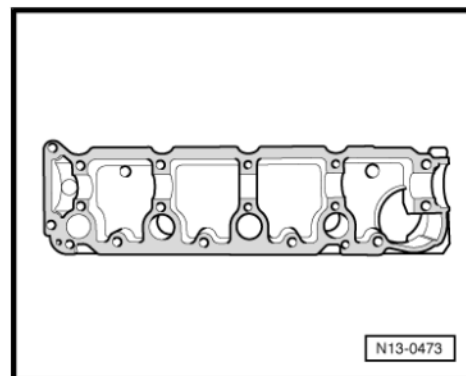




- Apply a thin and uniform film of Sealing compound for engines - AMV 188 001 02- or Sealing compound for engines - D 154 103 A1- on the clean sealing surface of the cylinder head cover.

**Note**

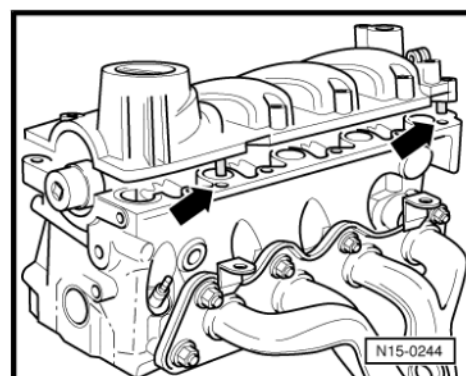
*Do not apply a thick film of Sealing compound for engines - AMV 188 001 02- or Sealing compound for engines - D 154 103 A1- otherwise, excess Sealing compound for engines - AMV 188 001 02- or Sealing compound for engines - D 154 103 A1- may penetrate the lubricating grooves or camshaft bearings, causing damage to the engine.*



- Place the cylinder head cover carefully in the vertical position from above with the guide pins in the holes of the engine cylinder head -arrows-.

**Note**

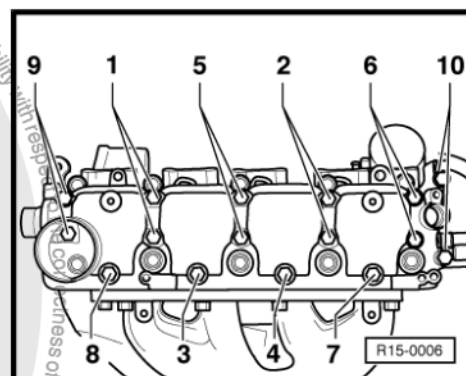
- ◆ *The cylinder head must be fit and fastened without interruptions, as the sealing surfaces start to harden as soon as they touch each other.*
- ◆ *The cylinder head cover screws must be replaced.*



- First tighten the screws in -Position 1- and -Position 2- alternately and in cross pattern with 6 Nm.
- Then, tighten the other screws in the indicated sequence with 6 Nm of torque.
- Then, tighten all screws 90° further.

**Note**

*After the cylinder head cover has been installed, the Sealing compound for engines - AMV 188 001 02- or Sealing compound for engines - D 154 103 A1- must dry for approx. 30 minutes.*



- Install the new camshaft seal ➔ [page 62](#) .
  - Continue installation in the reverse sequence to the removal.
- Installing the toothed belt and regulating command times  
➔ [page 45](#) .

## 2.5 Valve guides - check

Special tools and workshop equipment required

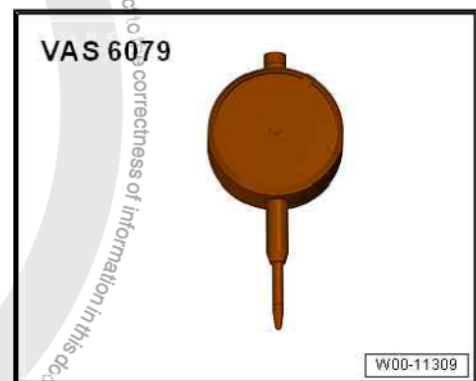




◆ Support - VW 387-



◆ Dial gauge - VAS 6079-

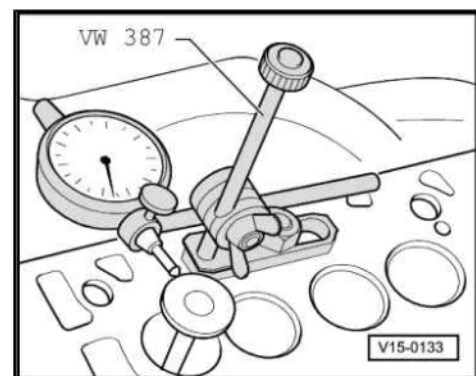


Test sequence

- Place a new valve on the guide. The end of the valve should be aligned with guide. Due to the various valve guide diameters, it is recommended that only one intake valve be used on the intake guide and one exhaust valve on the escape guide.
- Determine the tilting clearance. wear limit: 0.8 mm.

If the clearance is exceeded:

- Replace engine cylinder head.




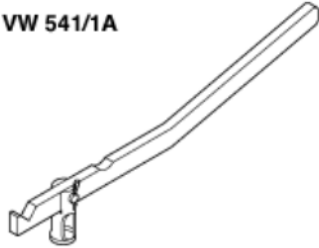

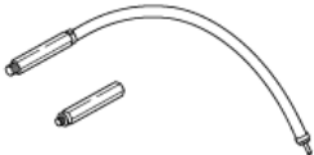
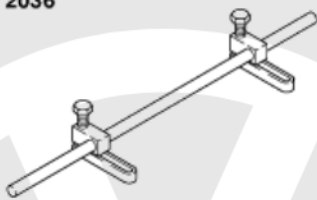

## 2.6 Valve rod sealant - replacement





**Special tools and workshop equipment required**

- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2" ) - VAG 1331-
- ◆ Lever - VW 541/1A-
- ◆ Flexible tube - VW 653/3-
- ◆ Device - 2036-
- ◆ Impact puller - 3364-

<p><b>V.A.G 1331</b></p> 	<p><b>VW 541/1A</b></p> 
<p><b>VW 541/5</b></p> 	<p><b>VW 653/3</b></p> 
<p><b>2036</b></p> 	<p><b>3364</b></p>  <p><b>W15-0103</b></p>



◆ Seal fitter - 3365-



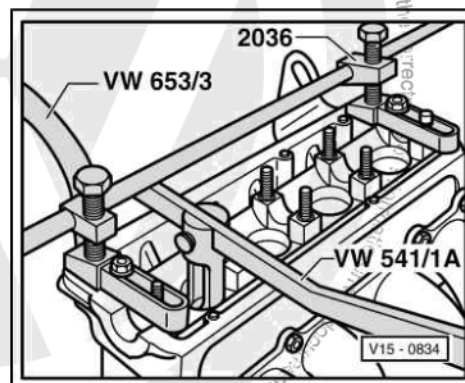
## 2.6.1 Removal

- Remove toothed belt ➔ [page 45](#) .
- Remove camshaft ➔ [page 64](#) .
- Remove the rockers together with the support elements and place them on a clean surface.
- Make sure the rockers and support elements are not mixed up.
- Loosen the spark plugs.
- Place the piston of the respective cylinder in the "Lower Dead Centre" position.
- Fasten the Device - 2036- to the cylinder head with the screws used in the cylinder head cover.
- Screw the Flexible tube VW 653/3- to the spark plug threads.
- Connect the pressure hose with at least 6-bar compressed air.
- Remove the springs of the valves with the Lever - VW 541/1A- and Device - 2036- .



### Note

*Stuck valve keys can be loosened by tapping slightly on the installation lever.*

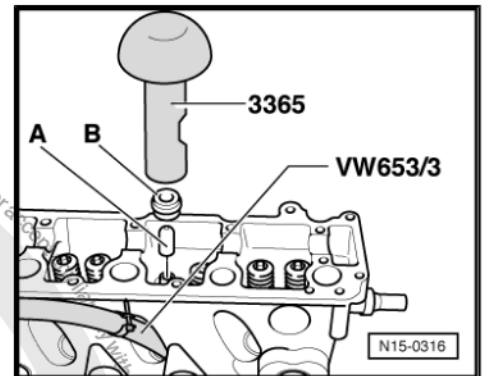


- Remove the valve seal with the Impact extractor - 3364- .



## 2.6.2 Installation

- Install the supplied plastic sleeve -A- into the respective valve guide. This procedure avoids damage to the new valve seal -B-.
- Place the new valve seal on the compressor with the Seal fitter - 3365- .
- Lubricate the sealing lip of the seal and carefully move it on the valve guide.





## 17 – Lubrication

### 1 Lubrication system components

#### 1.1 Lubricating system components - assembly overview



#### WARNING

*Always replace self-locking nuts and screws subject to angular torque*

#### 1 - Oil pressure switch - F1-

- ☐ In case of leakage, cut and replace the sealing ring.
- ☐ Tightening torque:  $20 \pm 3$  Nm
- ☐ Refer to [⇒ page 82](#).

#### 2 - Guide tube

#### 3 - Wood screw, 3 Nm

- ☐ Maximum rotation: 200 rpm.
- ☐ Fastened to the intake manifold.

#### 4 - Oil reservoir lid

- ☐ Replace the gasket if it is damaged.

#### 5 - Guide pipe funnel

- ☐ Remove it in case of oil drainage by absorption.

#### 6 - Oil dipstick

- ☐ Oil level must not exceed the max. mark!
- ☐ Marks [⇒ page 74](#)

#### 7 - Camshaft gear

- ☐ Check drive belt installation position.

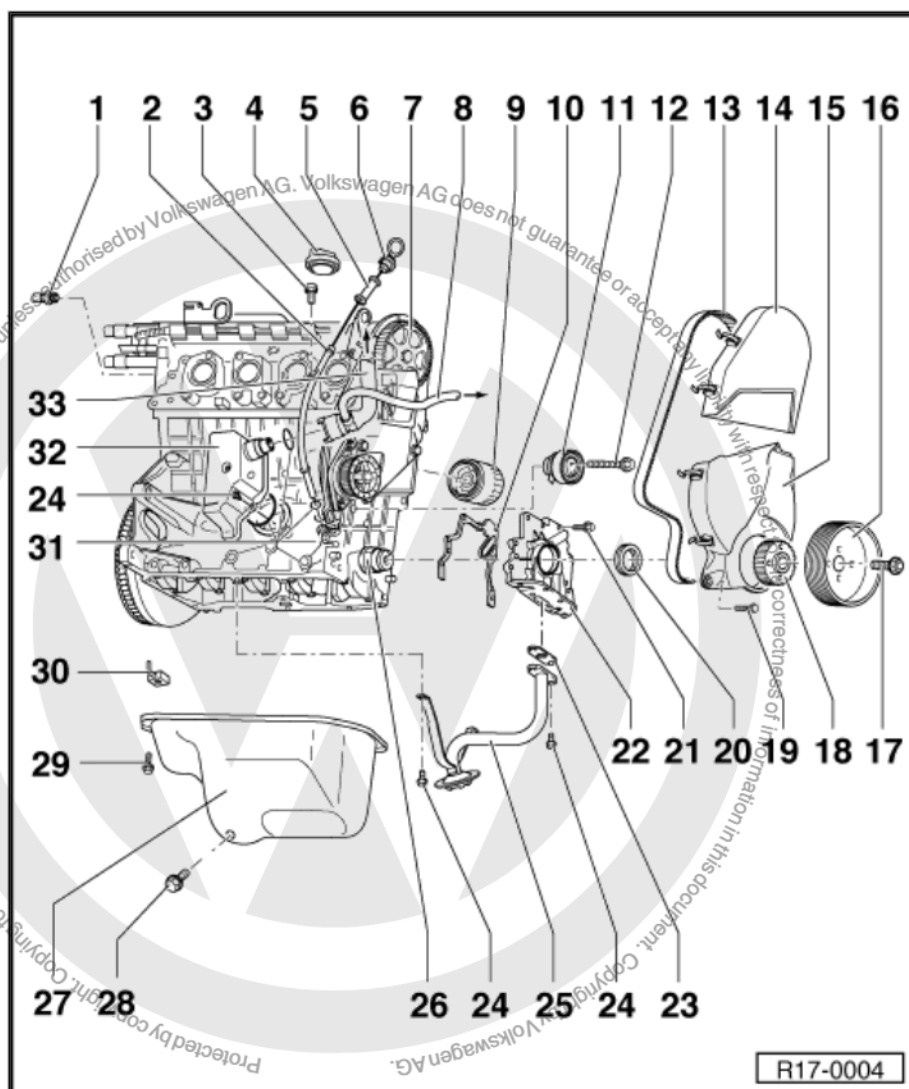
#### 8 - Up to the intake manifold

#### 9 - Oil filter

- ☐ Replace (vehicle on the lift) [⇒ page 77](#).
- ☐ Follow installation instructions printed on the oil filter.

#### 10 - Gasket

- ☐ Replace after each removal.
- ☐ It must be installed on the guides.





11 - Tensioning pulley

- ☐ Check ⇒ [page 43](#) .
- ☐ Toothed belt: remove and install: adjust ⇒ [page 45](#) .

12 - 25 Nm

13 - Toothed belt

- ☐ Before removing, mark the direction of operation.
- ☐ Check for wear.
- ☐ Do not bend.
- ☐ Remove and install, adjust ⇒ [page 45](#) .

14 - Upper cover to mechanical distributor

15 - Lower cover to the mechanical distributor

16 - Crankshaft pulley

- ☐ Observe fastening while installing.
- ☐ Remove and install ⇒ [page 45](#) .
- ☐ Remove and install of Poly-V belt ⇒ [page 18](#) .

17 - 90 Nm 90°

- ☐ Replace after each removal.
- ☐ To loosen and tighten, use Wrench - 3415- .
- ☐ Re-tightening can be carried out in several stages.
- ☐ The re-tightening angle can be measured with a Hazet 6690.

18 - Crankshaft gear

- ☐ Check position while installing the drive belt ⇒ [page 45](#) .

19 - 10 Nm

20 - Crankshaft seal (pulley side)

- ☐ Replace ⇒ [page 24](#) .

21 - 6 Nm + 40°

- ☐ Replace after each removal.

22 - Forward flange / oil pump

- ☐ Always replace the entire assembly.
- ☐ Should fit onto adjustment guides.
- ☐ To remove and install, remove the crankcase.
- ☐ While installing, observe the crankshaft dragging element.
- ☐ Oil pump, removal and installation ⇒ [page 79](#) .

23 - Gasket

- ☐ Replace after each removal.

24 - 10 Nm

25 - Oil suction tube

- ☐ Clean sieve, whenever dirty.

26 - Dragging element

- ☐ Lubricate with oil before installing the oil pump.

27 - Crankcase

- ☐ Remove and install ⇒ [page 74](#) .
- ☐ Before installing, clean the seating surface.
- ☐ With Silicone sealant for engine - D 176 404 A2 ou A3- ⇒ [page 74](#) .

28 - Oil draining plug, 30 Nm

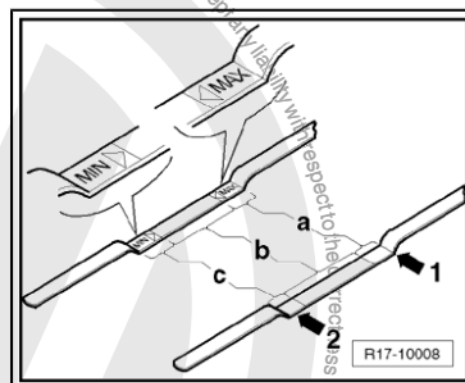
- ☐ With sealing ring.



- ☐ Replace after each removal.
- 29 - 15 Nm
  - ☐ Replace after each removal.
- 30 - Oil nozzle and valve
  - ☐ Not applicable.
- 31 - Sealing ring
  - ☐ Replace after each removal.
- 32 - Crankcase ventilation device
  - ☐ With electrical control of the gas passage.
- 33 - Up to the air filter

#### Marks on oil dipstick

- 1 - max. mark
- 2 - min. marks
- a - Region between the upper corner of the engraved region and the max. mark: do not refill with oil
- b - Oil level in the marked area: Refill with oil
- c - Region between min. mark and area below the marked region: Refill with up to 0.5 litre of engine oil



## 1.2 Engine oil



### Note

- ♦ Oil level should not exceed the Max. marking due to the risk of damage to the catalytic converter! Marks ⇒ [page 74](#)
- ♦ After filling, check the oil level with the oil dipstick ⇒ [page 74](#)

Check oil pressure ⇒ [page 82](#) .

Oil filling quantities:

- ♦ With a 3.3-litre oil filter

Engine oil specification:

- ♦ Utilize oils with high lubricating capacity as per "VW 502 00"  
⇒ Chemicals Manual .

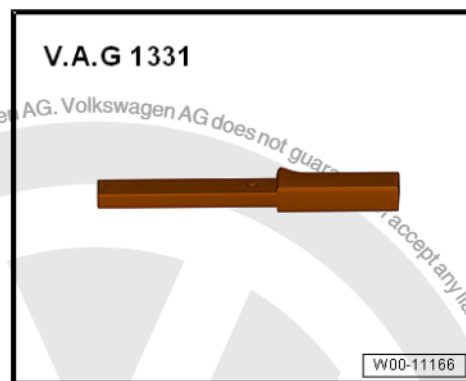
## 1.3 Oil pan- remove and install

Special tools and workshop equipment required

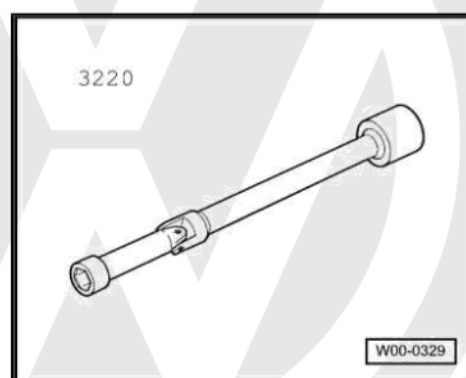




- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2") - VAG 1331-



- ◆ U/J extension and socket, 10 mm - 3220-



- ◆ Portable drilling machine with plastic brush
- ◆ Flat spatula
- ◆ Goggles
- ◆ Silicone sealant for engines - D 176 404 A2 ou A3 -

### 1.3.1 Removal

- Remove lower noise insulation from engine compartment: ⇒ Body – Repair; Rep. gr. 50 ; Body - Front part .
- Remove the heat deflector from the exhaust manifold.
- Remove the front exhaust pipe from exhaust manifold  
⇒ [page 148](#) .
- Remove the clutch compartment cover.
- Drain engine oil.



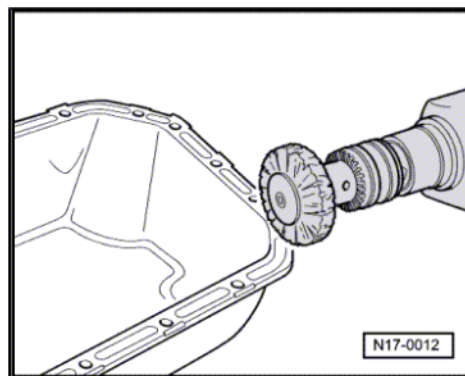
Note

*Follow the law regarding oil disposal!*

- Remove the four internal fastening screws in the crankcase, on the pulley side.
- Loosen the other fastening screws in the crankcase.
- Remove crankcase. If necessary, loosen the crankcase by tapping it slightly with a rubber hammer.
- Eliminate residues of Engine silicone sealant - D 176 404 A2 ou A3 - remaining on the engine block, with a flat spatula.



- Eliminate residues of Engine silicone sealant - D 176 404 A2 ou A3 - from the crankcase and its cover with a rotary brush, for example, a plastic brush attached to a portable drill (wear protective goggles).
- Clean the sealing surfaces. They must be free of oil and grease.

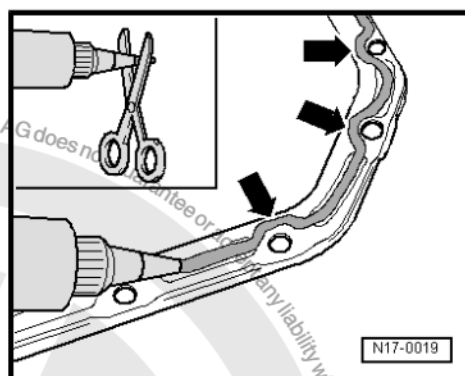


### 1.3.2 Installation



#### Note

- ◆ *Observe the use-by date for the Engine silicone sealant - D 176 404 A2 ou A3 - .*
  - ◆ *The crankcase must be installed within 5 minutes after applying the Engine silicone sealant - D 176 404 A2 ou A3 - .*
  - ◆ *The crankcase may be easily and safely installed by putting M 6 threaded pins in two points in the engine block flange.*
- Cut the pipe injector on front marking (Ø of injector is approx. 3 mm).

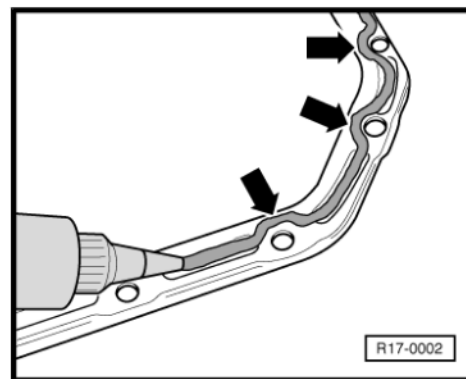




- Apply the Engine silicone sealant - D 176 404 A2 ou A3 - , as shown, onto clean sealing surface of the crankcase. The Engine silicone sealant - D 176 404 A2 ou A3 - cord must:
  - ◆ Be 2...3 mm thick.
  - ◆ Run on inside of the area around the screw holes -arrows-.

**Note**

*The cord of Engine silicone sealant - D 176 404 A2 ou A3- may not be thicker, otherwise the excess Engine silicone sealant - D 176 404 A2 ou A3- may reach the crankcase and obstruct the filter in the oil suction tube.*



- Install the crankcase immediately and tighten all the screws slightly.
- Tighten screws to 15 Nm.

**Note**

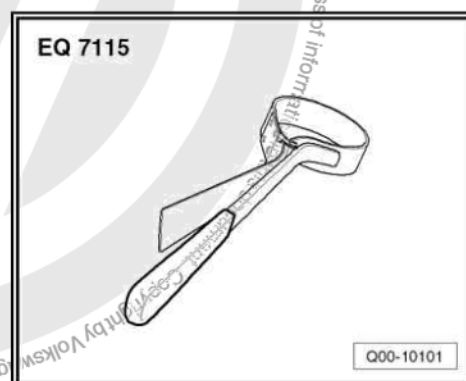
*Once the crankcase is installed, the Engine silicone sealant - D 176 404 A2 ou A3 - must dry for approximately 30 minutes. After this period, the oil may be refilled.*

## 1.4 Oil filter - replace

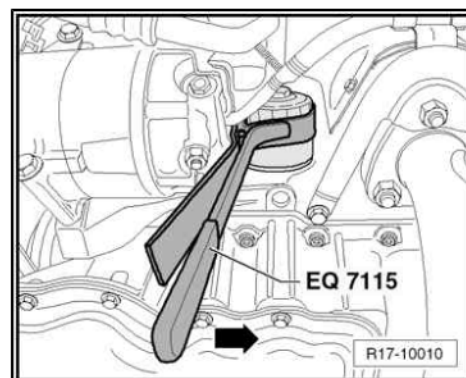
### 1.4.1 Filter with hex nut - replace

Special tools and workshop equipment required

- ◆ Chain wrench for oil filter - EQ 7115-



- With vehicle raised, install Chain wrench for oil filter - EQ 7115- according to illustration. Then, move wrench to right towards -arrow- until you can release it manually.
- Remove the filter with your hand.
- Lubricate sealing ring with clean engine oil.
- Install the filter and apply torque manually.





## 1.4.2 Filter without hex nut - replace

Special tools and workshop equipment required

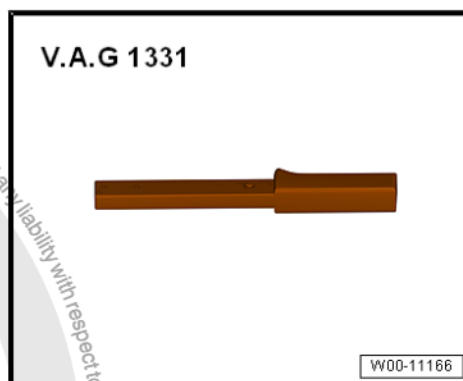
- ♦ Oil filter socket (14 faces) - 3417- or Oil filter remover (14 faces) - VW 5005P-



- ♦ Socket wrench - T02017A-



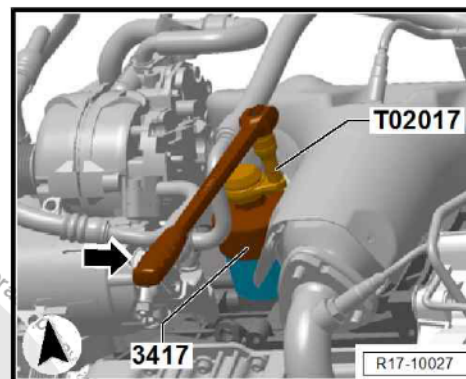
- ♦ "Torque wrench - 5 to 50 Nm (enc. 1/2") - VAG 1331-



- With the vehicle lifted, install the Oil filter socket (14 faces) - 3417- or Oil filter remover (14 faces) - VW 5005P- in the filter.
- Next, install the Socket wrench - T02017A- along with the articulated power cable in the Oil filter socket (14 faces) - 3417- or Oil filter remover (14 faces) - VW 5005P- .



- Move the articulated power cable to the right, releasing the filter.
- Remove the filter with your hand.
- Lubricate the new filter's sealing ring with clean engine oil.
- Manually install the filter.
- Next, install the Socket wrench - T02017A- along with the "Torque wrench - 5 to 50 Nm (fit. 1/2")" - VAG 1331- , in the Oil filter socket (14 faces) - 3417- or Oil filter remover (14 faces) - VW 5005P- .
- Move the "Torque wrench - 5 to 50 Nm ( fit. 1/2")" - VAG 1331- to the left, applying the torque indicated in the oil filter engraving.



#### Note

Follow installation instructions printed on the oil filter.

### 1.5 Oil pump - remove and install

Special tools and workshop equipment required

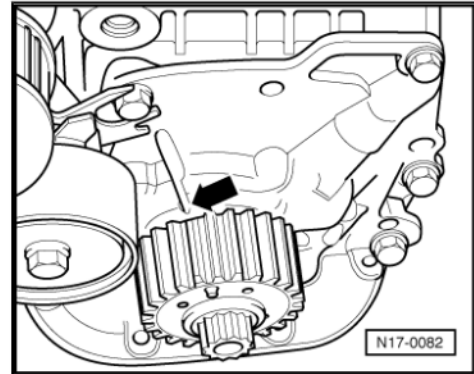
- ◆ Key - 3415-
- ◆ Assembly sleeve - T10022-
- ◆ Fitting Device - 3083-
- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2") - VAG 1331-
- ◆ Torque meter - 40 to 200 Nm ( enc. 1/2") - VAG 1332-

<p><b>3415</b></p>	<p><b>T 10022</b></p>
<p><b>3083</b></p>	<p><b>V.A.G 1331</b></p>
<p><b>V.A.G 1332</b></p>	<p><b>W17-0023</b></p>



## 1.5.1 Removal

- Remove toothed belt ➔ [page 45](#) .
- Put the crankshaft in cylinder 1 TDC -arrow-: The tooth marked on the camshaft gear must align with the mark "2V" on the oil pump.

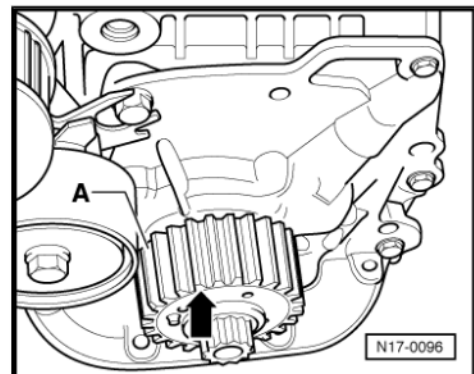


- Turn the crankshaft or gear of the TDC, three teeth anti-clockwise: On the right side of the flat tooth -A- of the gear, the third tooth -arrow- must be aligned with the TDC mark "2V" on the oil pump housing.

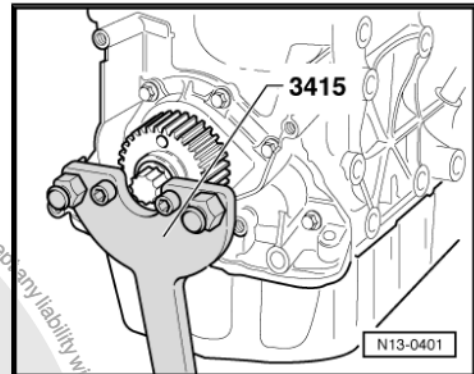


### Note

*With this adjustment, the crankshaft is in position for oil pump installation. One of the four dragging polygonal cams on the crankshaft will be on top.*



- Remove the crankshaft gear after immobilizing it with a Wrench - 3415- .
- Remove timing belt tensioning element.
- Remove the oil pan ➔ [page 74](#) .
- Remove the oil suction tube ➔ [Item 25 \(page 73\)](#) .
- Remove oil pump.
- Remove the sealing gasket.
- Remove seal residues from the engine block with a flat spatula.
- Clean the sealing surfaces, which must be free of grease and oil.

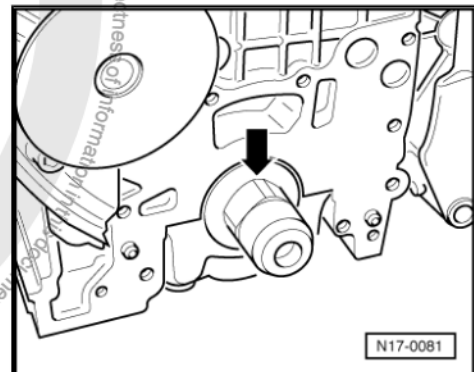


## 1.5.2 Installation

### Conditions

- One of the four dragging polygonal cams on the crankshaft should be on top.

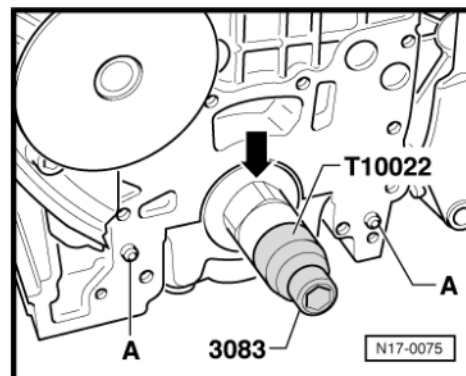
### Operation sequence



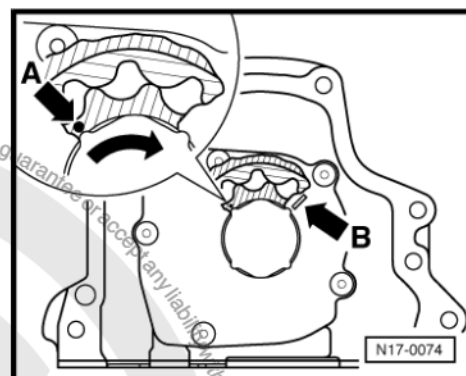




- Position the Allen screw of the Fitting Device - 3083- with an Assembly sleeve - T10022- on the crankshaft and tighten manually.
- Place the new sealing gasket onto the guides -A-.



- Put the -arrow A- mark of the oil pump inner rotor in the installation position - -arrow B- mark of the oil pump housing cover.
- Apply oil to the four dragging polygonal cams on the crankshaft.
- Carefully place the oil pump on the four dragging polygonal cams on the crankshaft.
- If necessary, align the inner rotor by slightly by turning the four dragging polygonal cams on the crankshaft.
- Then carefully move the oil pump over the guides.
- Screw in the oil pump. Tightening torque: 6 Nm + 40°.
- Remove the Assembly sleeve - T10022- .
- Install oil suction tube ⇒ [Item 25 \(page 73\)](#) .
- Install the oil pan ⇒ [page 74](#) .



Installing the toothed belt and adjusting the command times  
⇒ [page 45](#) .

## 1.6 Oil pressure switch - F1- - remove and install

### 1.6.1 Oil pressure switch - F1- - remove and install

Special tools and workshop equipment required

- ◆ 24 mm articulated socket - T40175-

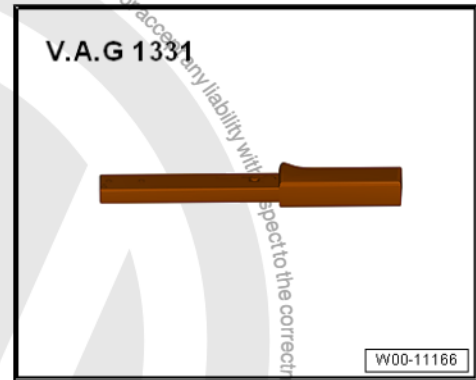




Fox 2004 ➤

4 - Cyl. injection engine (1.4 l) - Edition 05.2014

- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2") - VAG 1331-



Removal:



Caution

*Protect the components below with a cleaning cloth in order to prevent damages due to engine oil leaking.*

- Disconnect the connector.
- Remove the Oil pressure switch - F1- from the engine cylinder head.

Installation:

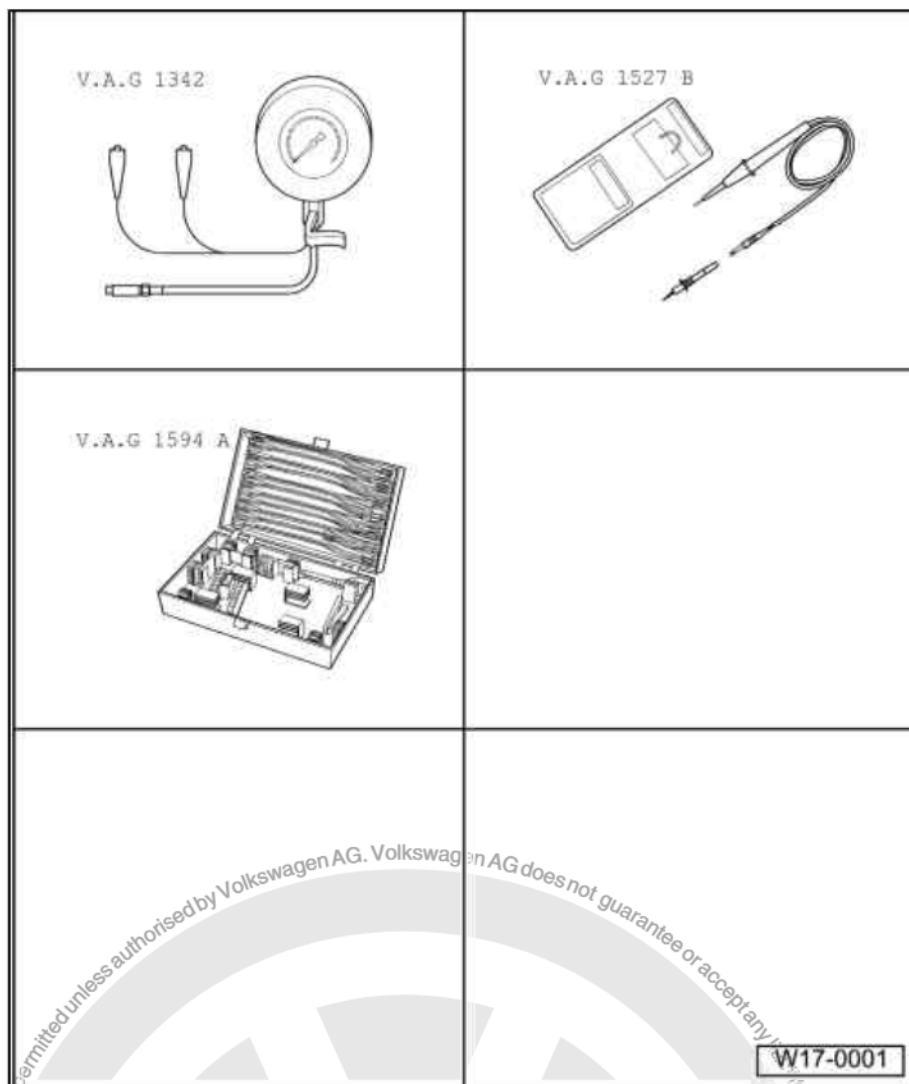
- Install the Oil pressure switch - F1- on the engine cylinder head as quickly as possible and apply a tightening torque of 20 Nm.
- Connect the connector.
- Remove the cleaning cloth from underneath the Oil pressure switch - F1- .

## 1.7 Oil pressure and Oil pressure switch - F1- - check



# Special tools and workshop equipment required

- ◆ Oil pressure gauge - VAG 1342-
- ◆ Test probe or VAG 1527B - EQ 7300-
- ◆ Auxiliary measuring cable set - VAG 1594C-



## Test conditions

- Check that the engine oil level is correct ⇒ [page 74](#)
- Engine oil temperature must be at least 80°C (the Radiator fan of the cooling system must have worked once).



## Note

Operation and repair test of visual and acoustic oil pressure indicator ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



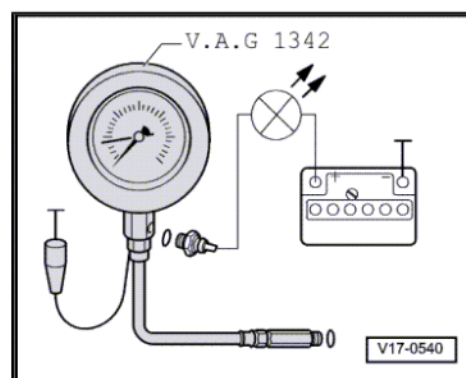
### Test sequence

- Remove the Oil pressure switch - F1- and screw in the test device.
- Install the test device in the place of the oil pressure switch in the engine head.
- Place the brown cable of the test device in the earth (-).
- Connect the Test probe or VAG 1527B - EQ 7300- with the Auxiliary measurement cable set - VAG 1594C- in the positive side of the battery (+) and the oil pressure switch. The LED shall not light up.
- If the LED does light up, replace the Oil pressure switch - F1- .

If the LED does not light up:

- Operate the engine and increase the engine speed slowly with 0.3...0.6-bar pressure, the LED should light up, otherwise, replace oil pressure switch.
- Continue to increase engine speed. At 2000 rpm and an oil temperature of 80°C, the oil pressure should be at least 2.0 bar.

At higher speeds, oil pressure must not exceed 7.0 bar.





## 19 – Cooling

### 1 Cooling system components - remove and install



#### WARNING

*Remember the following when performing installation work, especially inside the engine compartment where there is little space:*

- ◆ *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling fluid and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.*
- ◆ *Allow easy access to all the moving or hot parts.*



#### Note

- ◆ *The cooling system is under pressure when the engine is hot. Thus, it is necessary to reduce the pressure before conducting repairs.*
- ◆ *Hose connection are fastened by spring clamps. For repairs, use spring clamps only.*
- ◆ *To install spring clamps, we recommend using the VAS 5024A or Standard-type clamp pliers - VW 5162- or the Clamp pliers - VAG 1921-.*
- ◆ *The cooling system hoses should be installed without tension and without their coming into contact with other components (observe the marks on the cooling system connection on the hose).*

Check the cooling system leaks with the Engine cooling system tester - VAG 1274- or Engine cooling system tester - VAG 1274B- and with the Adapter for VAG 1274 - VAG 1274/8- and the Adapter for VAG 1274 - VAG 1274/9-.

Cooling system components, body side ⇒ [page 85](#).

Cooling system components, engine side ⇒ [page 87](#).

Cooling system hoses connection diagram ⇒ [page 89](#).

Drain and replenish the cooling system ⇒ [page 90](#).

Coolant preparation instructions ⇒ [page 92](#).

#### 1.1 Cooling system components, body side





## 1 - Radiator

- ☐ Remove and install  
⇒ [page 98](#) .
- ☐ After replacement,  
change all coolant.

## 2 - Fastening pin

- ☐ Replace.

## 3 - Upper hose of the cooling system

- ☐ Fastened to the radiator  
with a clip.
- ☐ Make sure it is well fastened.
- ☐ Cooling system hoses  
connection diagram  
⇒ [page 89](#) .

## 4 - Air deflector

## 5 - 5 Nm

## 6 - Right radiator fan. - V35-

- ☐ In vehicles with air conditioning up to 20.03.06.

## 7 - Clip

- ☐ Make sure it is well fastened.

## 8 - Support

- ☐ From electrical fan.

## 9 - Connector

- ☐ Of the Radiator fan - V7- .
- ☐ Not applicable.

## 10 - Radiator fan - V7-

## 11 - For cooling system thermostat valve body

- ☐ Cooling system hose connection diagram ⇒ [page 89](#) .

## 12 - Coolant reservoir

Check for cooling system leaks using the Engine cooling system tester - VAG 1274- or Engine cooling system tester - VAG 1274B- and the Adapter for VAG 1274 - VAG 1274/8- .

## 13 - Lid

Check for cooling system leaks using the Engine cooling system tester - VAG 1274- or Engine cooling system tester - VAG 1274B- with the Adapter for VAG 1274 - VAG 1274/9- .

- ☐ Test pressure 1.4...1.6 bar.

## 14 - Support

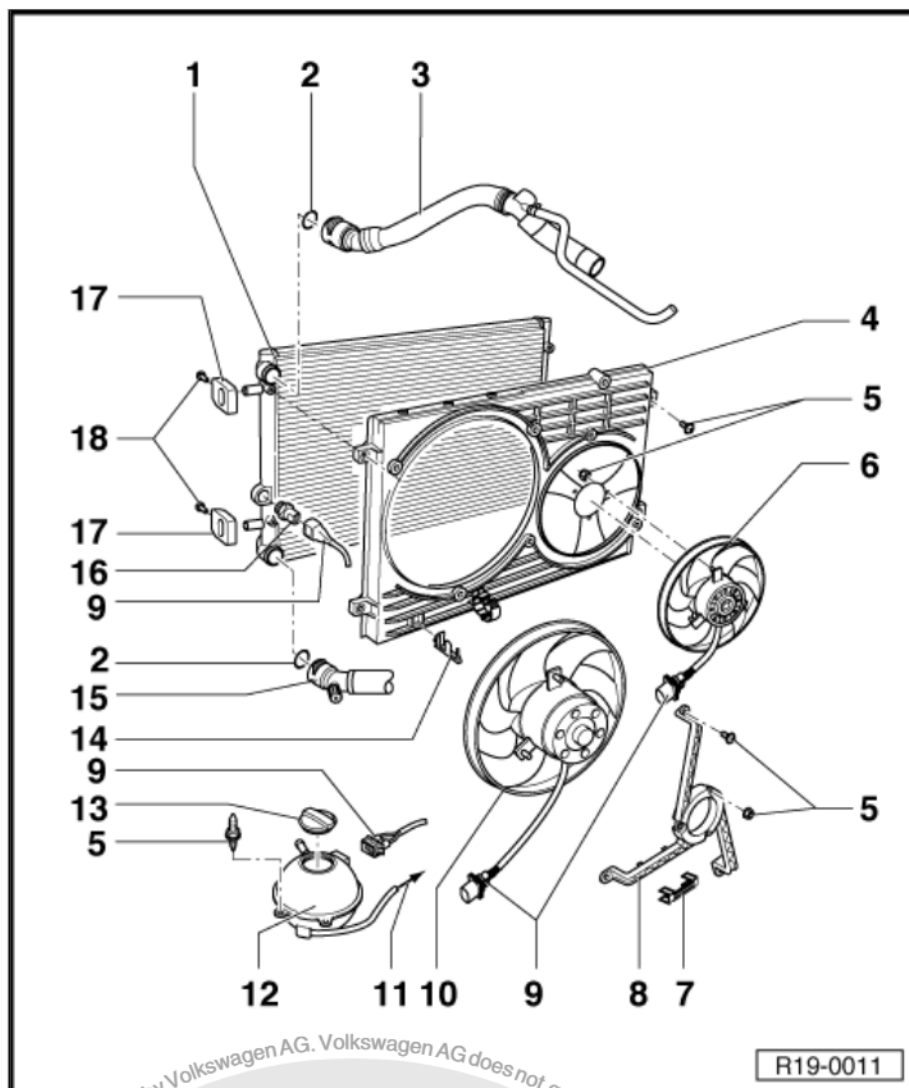
- ☐ For the Radiator fan - V7- connector.

## 15 - Lower hose of the cooling system

- ☐ Fastened to the radiator with retaining clip.
- ☐ Make sure it is well fastened.
- ☐ Cooling system hose connection diagram ⇒ [page 89](#) .

## 16 - Radiator fan thermal switch, F18- , 35 Nm

- ☐ Of the Radiator fan - V7- .
- ☐ Not applicable.







17 - Support

- ☐ For radiator.
- ☐ Observe installation position.
- ☐ Observe various models.

18 - 5 Nm

## 1.2 Cooling system components, engine side

1 - Flange

2 - 9 Nm

3 - Fastening pin

- ☐ Replace.

4 - Thermostatic valve

- ☐ Check for proper operation. Heat the valve with water. The thermal element pin should move outwards.
- ☐ Temperature test: Opening beginning (approx. 84° C) and opening end (approx. 98° C) cannot be performed.

5 - To the heat exchanger

- ☐ Cooling system hose connection diagram  
⇒ [page 89](#).

6 - From the coolant tank

- ☐ Cooling system hose connection diagram  
⇒ [page 89](#).

7 - Thermostat valve housing

8 - From the heat exchanger

- ☐ Cooling system hose connection diagram  
⇒ [page 89](#).

9 - Cooling system tube

- ☐ Cooling system hose connection diagram  
⇒ [page 89](#).

10 - Sealing ring

- ☐ Replace.

11 - Engine block water pump housing

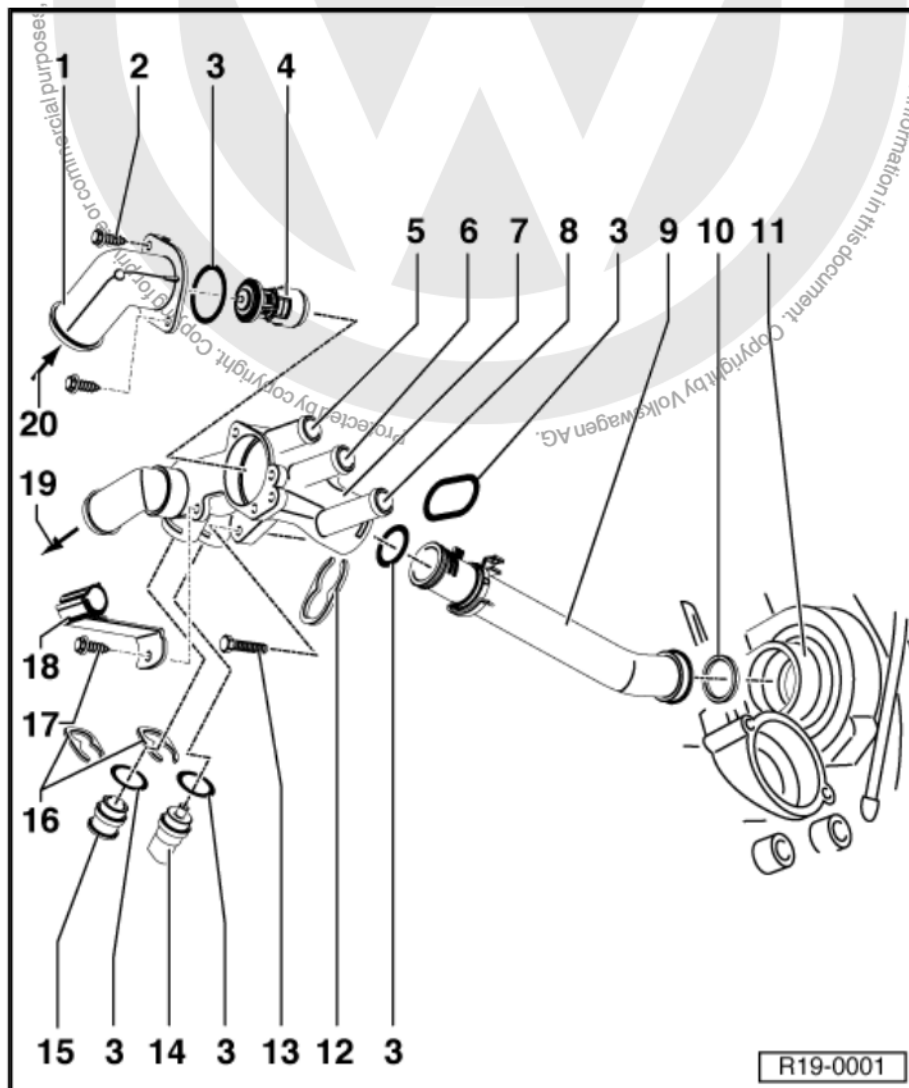
12 - Clip

- ☐ Make sure it is well fastened.

13 - 10 Nm

14 - Cooling system temperature sensor - G62-

- ☐ For Engine control unit - J623-.
- ☐ If necessary, depressurize the system before removal.





15 - Plug

- ☐ If necessary, depressurize the system before removal.

16 - Clip

- ☐ Make sure it is well fastened.

17 - 6 Nm

18 - Support

19 - For the radiator, below

- ☐ Cooling system hose connection diagram ⇒ [page 89](#) .

20 - From radiator

- ☐ Cooling system hose connection diagram ⇒ [page 89](#) .

## 1.2.1 Water pump side



### WARNING

*Always replace self-locking nuts and screws subject to angular torque*

1 - Water pump

- ☐ With integrated sealing gasket.
- ☐ The sealing gasket should not be separated from the pump.
- ☐ In case of faults and leaks, replace the entire pump along with the sealing.
- ☐ Check smooth operation.
- ☐ Remove and install ⇒ [page 100](#) .

2 - Mechanical distribution rear cover

3 - Camshaft gear

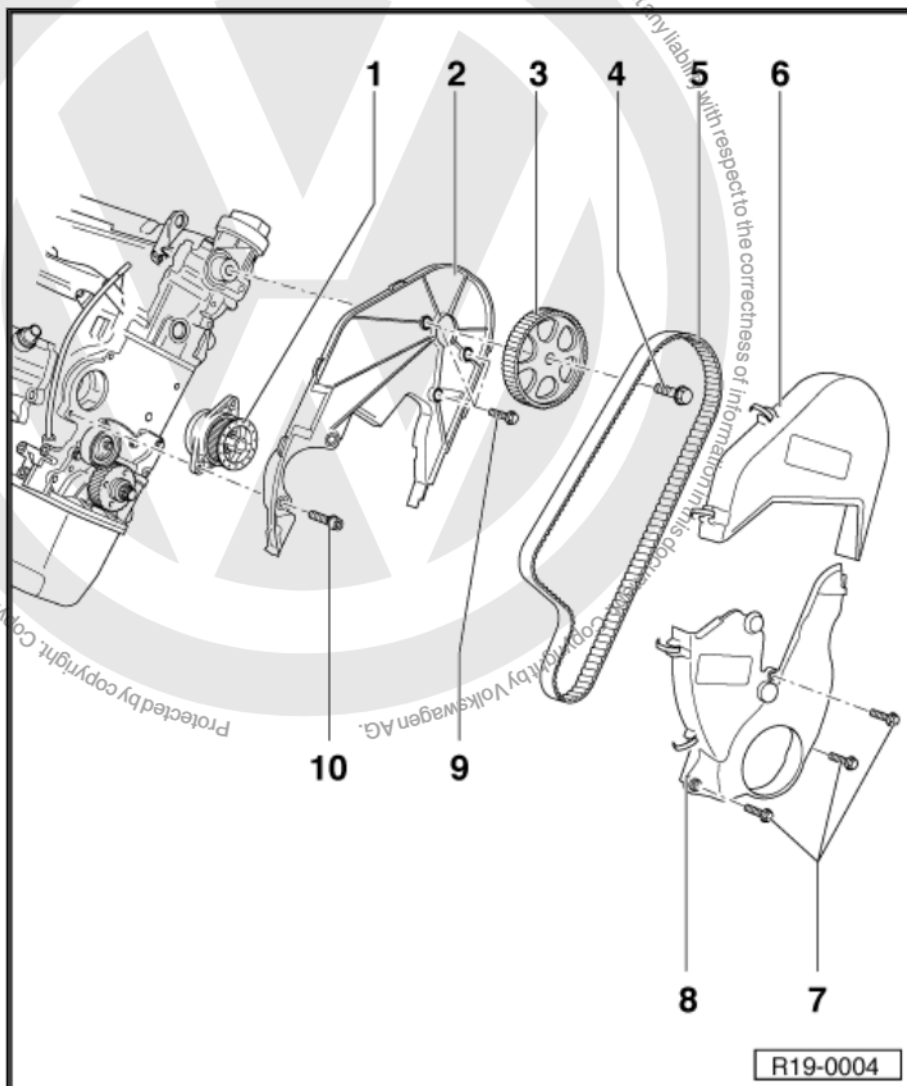
- ☐ Check the fastening during installation.
- ☐ Check the installation position of toothed belt ⇒ [page 45](#) .

4 - 20 Nm 90°

- ☐ Replace after each removal.
- ☐ To loosen and tighten, immobilize the camshaft gear with the Special wrench - 3036- .

5 - Toothed belt

- ☐ Mark rotation direction before removal.
- ☐ Check for wear.





- ☐ Do not bend.
- ☐ Remove and install, adjust ➤ [page 45](#) .

6 - Upper cover to mechanical distributor

7 - 10 Nm

8 - Lower cover to the mechanical distributor

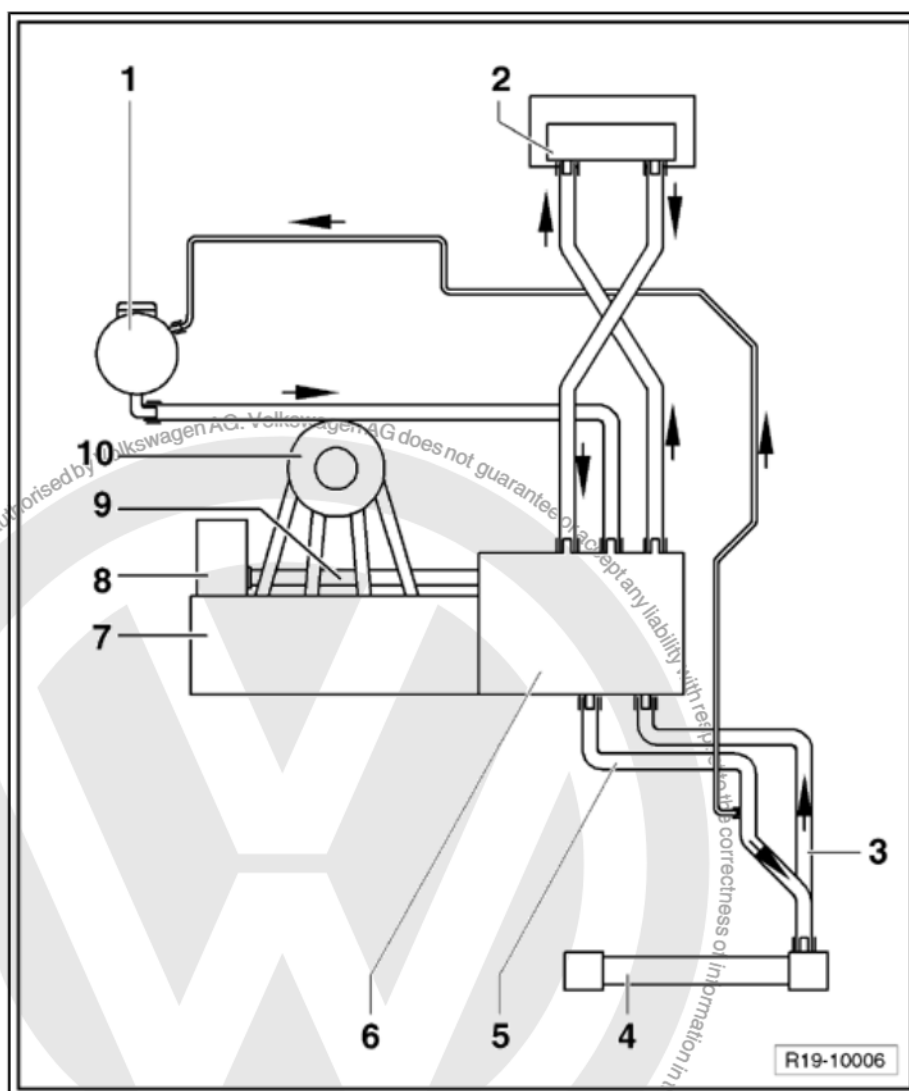
9 - 10 Nm

- ☐ Apply Liquid sealant - D 000 600 A2- .

10 - 20 Nm

### 1.3 Hose connection diagram for cooling system

- 1 - Coolant reservoir
- 2 - Heat exchanger
- 3 - Lower hose of the cooling system
- 4 - Radiator
- 5 - Upper hose of the cooling system
- 6 - Thermostat valve housing
- 7 - Engine cylinder head / engine block
- 8 - Water pump
- 9 - Cooling system tube
- 10 - Suction tube

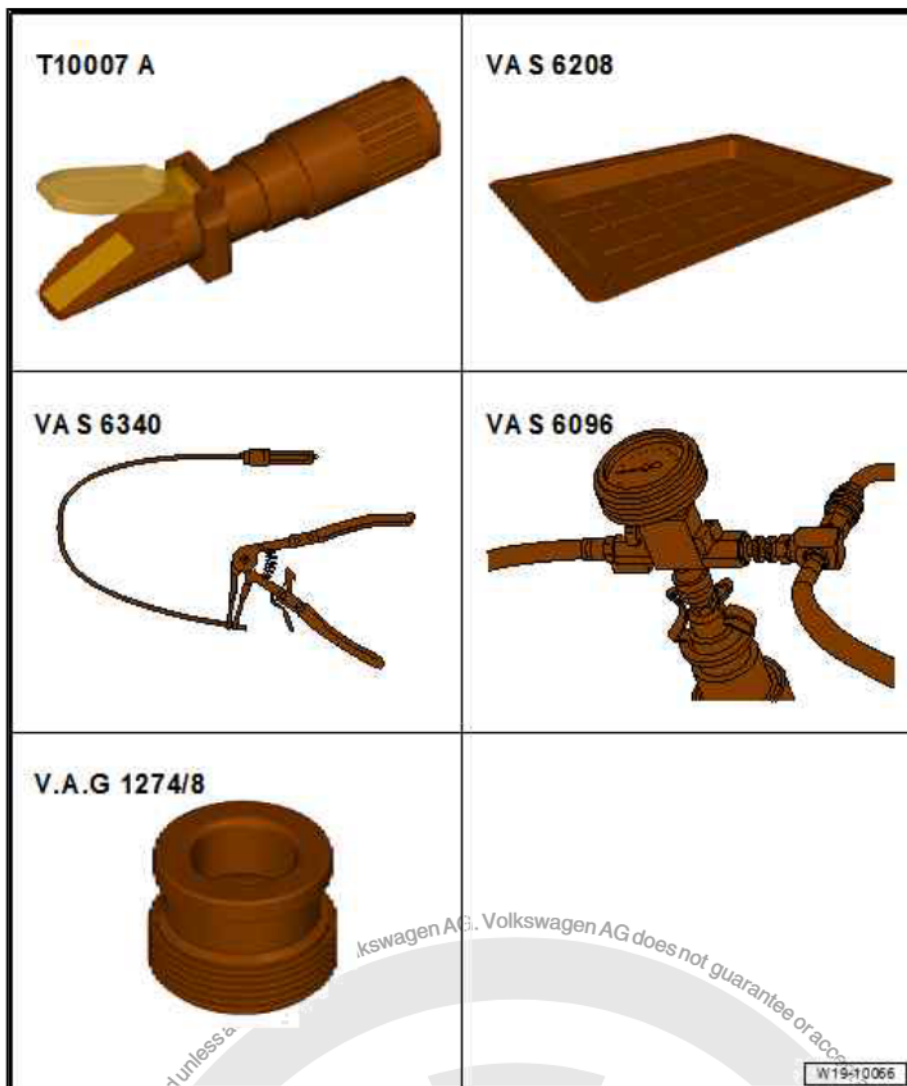




## 1.4 Cooling system - drainage and replenishment

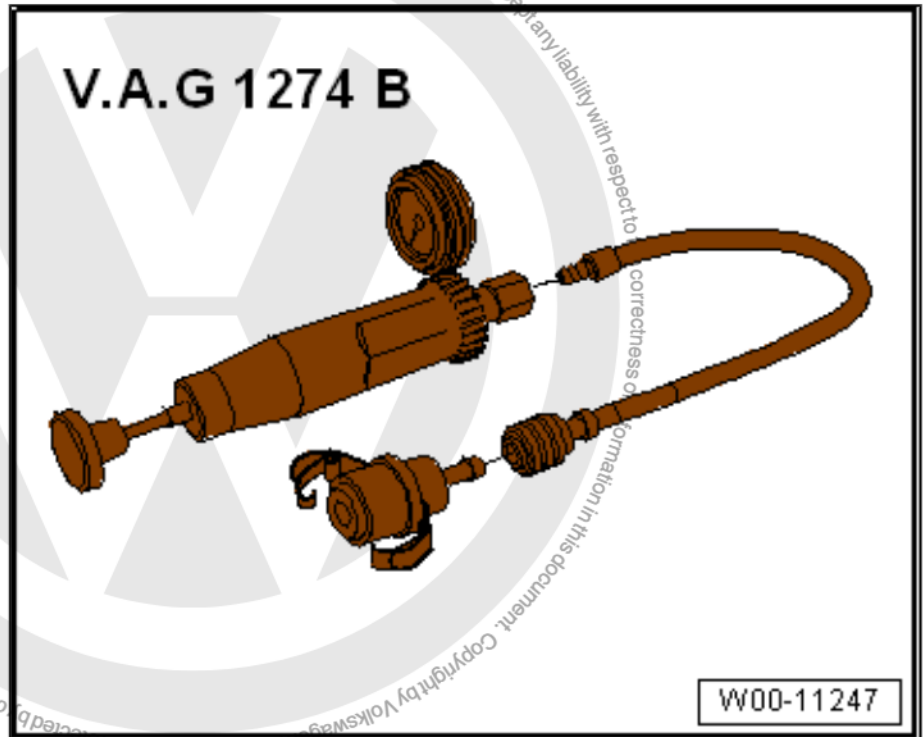
Special tools and workshop equipment required

- ◆ Refractometer - T10007A-
- ◆ Oil sump - VAG 1306- or Oil sump - VAS 6208-
- ◆ Standard-type clamp pliers - VW 5162- or Standard-type clamp pliers - VAS 5024A- or Clamp pliers - VAG 1921- or Clamp pliers - VAS 6340-
- ◆ Cooling system supply unit - VAS 6096-
- ◆ Adapter for VAG 1274 - VAG 1274/8-





- ♦ Engine cooling system tester - VAG 1274- or Engine cooling system tester - VAG 1274B-



### 1.4.1 Drain



#### WARNING

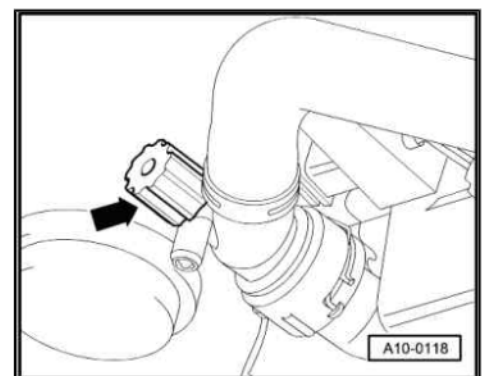
*Hot vapours may escape when the coolant reservoir is opened; cover it with a cloth and open carefully.*

- Open the coolant tank lid.
- Remove lower noise insulation from engine compartment: ➔ Body – Repair; Rep. gr. 50 ; Body - Front part .
- Disconnect the drainage plug from the radiator cooling fluid -arrow-.



#### Note

*Follow the recommendations for coolant disposal!!*







## 1.4.2 Replenishing



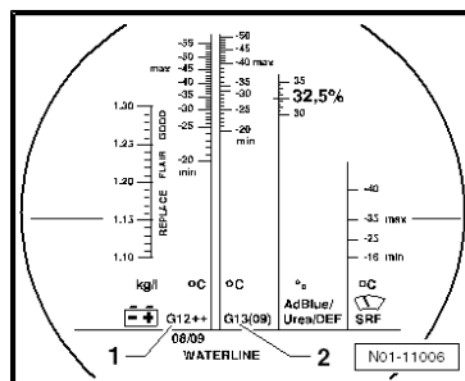
### Note

- ♦ One of the elements that most affect coolant efficiency is the water used in its preparation. The quality of the water to be used is based on multiple substances, which may present different specifications depending on the country or even in different regions. Fresh water meets all requirements. Therefore, the coolant must be prepared with fresh and drinkable water, either when preparing new filling procedures or coolants used to top off the coolant tank.
- ♦ Only the antifreeze additive may be used. Correspondence: ➔ Electronic Parts Catalogue "ETKA". It is identified by the pink colour.
- ♦ Do not mix antifreeze additive with other types of antifreeze additives from other suppliers under any circumstance.
- ♦ A brown colour in the coolant reservoir indicates that the antifreeze additive has been mixed with other antifreeze additives. In this case, replace all of the coolant.
- ♦ The antifreeze additive prevents damages caused due to corrosion, freezing, or sludge sedimentation, further increasing the coolant's boiling temperature. Therefore, the cooling system must always have the recommended mixture of antifreeze and anti-corrosion products.
- ♦ Due to the high boiling temperatures it provides, antifreeze is especially helpful in tropical countries, ensuring safe operation when the engine is submitted to heavy-duty work.
- ♦ Antifreeze protection must be assured to approximately  $-25^{\circ}\text{C}$  (in countries with arctic climates, to approximately  $-35^{\circ}\text{C}$ ).
- ♦ Coolant concentration must not be diluted by adding fresh and drinkable water during hot seasons, or in countries with hot climates. The percentage of antifreeze should be at least 40 %.
- ♦ If the climate requires greater antifreeze protection, the antifreeze additive percentage may be increased, but to a maximum of 60 % (antifreeze protection up to  $-40^{\circ}\text{C}$ ). The higher proportion lowers cooling capacity and antifreeze protection.
- ♦ Use the Refractometer - T10007A- to determine the antifreeze protection and the corresponding antifreeze protection percentage.
- ♦ Do not reuse used coolants, including in situations in which drainage is required.
- ♦ Use only clean drinkable water to prepare the coolant.

### Recommended proportions:

Antifreeze protection up to	Antifreeze proportion	Coolant additive <sup>7)</sup>	Water <sup>7)</sup>
$-25^{\circ}\text{C}$	40 %	2.25 l	3.35 l
$-35^{\circ}\text{C}$	50 %	2.8 l	2.8 l

7) The coolant volume may vary according to the equipment on each vehicle.

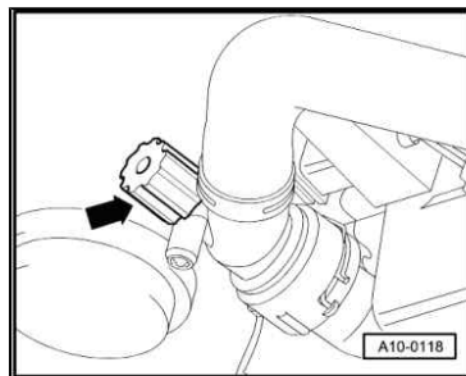






- Close the drainage plug -arrow- of the cooling system.
- Install engine compartment lower noise insulation: ⇒ Body – Repair; Rep. gr. 50 ; Body - Front part .

With Cooling system supply unit - VAS 6096-



- Remove coolant expansion tank lid.
- Install the Adaptor for VAG 1274 - VAG 1274/8- on the coolant tank.

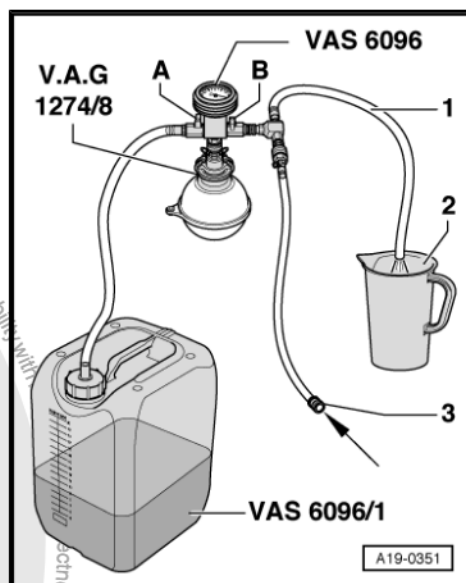


- Install the Cooling system supply unit - VAS 6096- .



#### Note

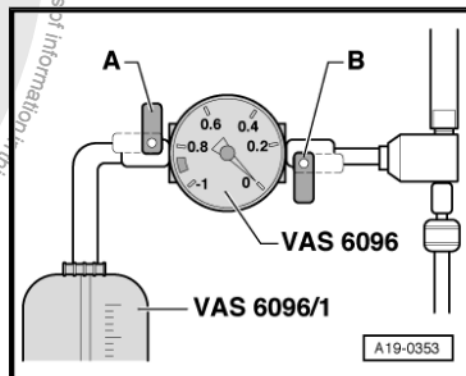
*A small quantity of coolant is removed along with the air discharge, which must be collected.*



- Close the valves -A- and -B-, allowing levers to seat transversely to the passage direction.

- Connect the hose -3 - to the compressed air system.

The compressed air pressure must be 6 to 10 bar.





- Open the valve -B- placing the lever in the passage direction.

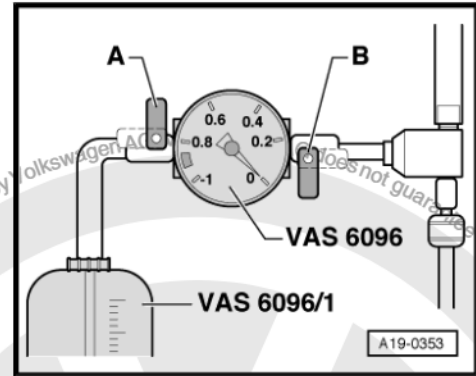
The aspiration jet pump generates vacuum in the cooling system; the instrument gauge must move towards the green area.

- Briefly open valve -A- placing the valve in the direction of the flow, in order to fill the Cooling system supply unit - VAS 6096- coolant reservoir hose with coolant.
- Close valve -A-.
- Leave valve -B- open for more than 2 minutes.

The aspiration jet pump continues to generate vacuum in the cooling system; the instrument gauge must stay in the green area.

- Close valve -B-.

The instrument gauge must remain still in the green area; the vacuum in the cooling system is sufficient to ensure proper supply.



#### Note

- ♦ *If the gauge is below the green area, the operation must be repeated.*
- ♦ *If the vacuum reduces, check the cooling system for exhaust points.*

- Remove the compressed air hose.
- Open the valve -A-.

Due to the vacuum in the cooling system, the coolant is aspirated from the Cooling system supply unit - VAS 6096- into the cooling system.

- Remove the Cooling system supply unit - VAS 6096- and the VAG 1274 adaptor - VAG 1274/8- from the coolant tank.
- Supply the coolant tank until the maximum mark.

- Install the coolant tank cap.

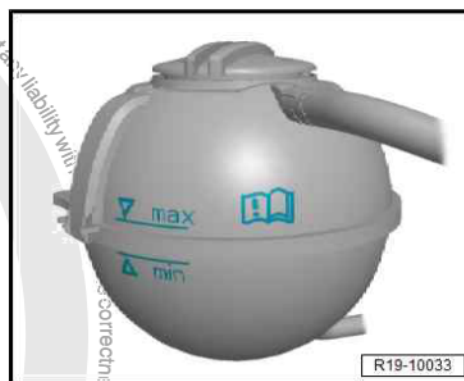
Without the Cooling system supply unit - VAS 6096-





- Fill with coolant up to the -max.- mark on the coolant reservoir.

Without the Cooling system supply unit - VAS 6096-



- Remove coolant expansion tank lid.
- Supply the coolant tank until reaching the maximum mark.
- Install the Adaptor for VAG 1274 - VAG 1274/8- on the coolant tank.
- Attach the Connection terminal - V.A.G 1274 B/1- to the VAG 1274B adaptor - VAG 1274/8-.

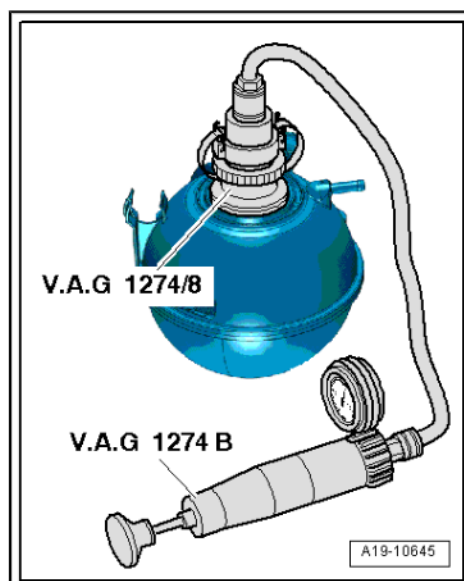


- Connect the Connection terminal - V.A.G 1274 B/1- to the Engine cooling system analyzer - VAG 1274 B- through the flexible connection tube.
- With the Engine cooling system analyzer - VAG 1274B- , generate a pressure of approx. 1.5 bar.



**DANGER!**

*Risk of burns! Before removing the Engine cooling system analyzer - VAG 1274B- from the VAG 1274 adaptor - VAG 1274/8- and the Connection terminal - V.A.G 1274 B/1- , eliminate all system pressure. Press the pressure relief valve in the Engine cooling system analyzer - VAG 1274B- , until the manometer reads »0«.*



- Supply the coolant tank until the upper edge.





- Install the coolant tank cap.
- Switch off the air conditioning, if applicable.
- Turn off heating start device.
- Start the engine and keep it idling until it is heated.
- Maintain engine rotation at approx. 3800 rpm, until the Radiator fan - V7- is activated.
- After the Radiator fan - V7- is activated, maintain engine rotation at approx. 3800 rpm for an additional 5 minutes.
- Stop the engine.



#### WARNING

*When opened, hot vapours may come from the coolant tank. Wear protection goggles and clothing to prevent eye injuries and burns. Place a cloth on the tank flap and open it carefully.*



- Check coolant level and top off if necessary.
- With the engine under normal operating temperature, the coolant may be at the "max." mark or above.
- With the cold engine, the coolant level must be between the "min. mark" and "max. mark".



#### WARNING

*Hot vapours may escape when the coolant reservoir is opened; cover it with a cloth and open carefully.*

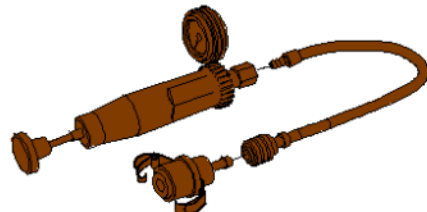
- Check coolant level and, if necessary, top it up. When the engine is hot, coolant level should be at the max. mark; when the engine is cold, it should be at the central mark, between the max. and min. marks.

## 1.5 Cooling system - check air-tightness

Special tools and workshop equipment required

- ♦ Engine cooling system tester - VAG 1274- or Engine cooling system tester - VAG 1274B-

#### V.A.G 1274 B



W00-11247



- ◆ Adapter for VAG 1274 - VAG 1274/8-

V.A.G 1274/8



W00-11182

- ◆ Adapter for VAG 1274B - VAG 1274/9-

V.A.G 1274/9



W00-11176

#### Checking condition

- Engine under operating temperature.

#### Checking sequence



#### WARNING

- ◆ *Hot vapours may escape when the coolant reservoir is opened; cover it with a cloth and open carefully.*
- ◆ *Safety measures must be followed when working on the cooling system*

- Remove coolant expansion tank lid.
- Install the Adapter for VAG 1274 - VAG 1274/8- on the coolant tank.
- Attach the Connection terminal - V.A.G 1274 B/1- to the VAG 1274B adaptor - VAG 1274/8- .





- Connect the Connection terminal - V.A.G 1274 B/1- to the Engine cooling system analyzer - VAG 1274B- through the flexible connection tube.
- With the Engine cooling system analyzer - VAG 1274B- , generate a pressure of approx. 1.4 bar.



#### DANGER!

*Risk of burns! Before removing the Engine cooling system analyzer - VAG 1274B- from the VAG 1274 adaptor - VAG 1274/8- and the Connection terminal - V.A.G 1274 B/1- , eliminate all system pressure. Press the pressure relief valve in the Engine cooling system analyzer - VAG 1274B- until the manometer reads »0«.*

If the pressure does not drop:

- Locate and eliminate the exhaust area in the engine compartment (upper engine part) and on the lower part of the vehicle (lower engine part).

Coolant tank flap - check safety valve

- Install the coolant tank flap -1- in the VAG 1274B adaptor - VAG 1274/9- -2-.
- Attach the Connection terminal - V.A.G 1274 B/1- to the VAG 1274B adaptor - VAG 1274/9- .
- Connect the Connection terminal - V.A.G 1274 B/1- to the Engine cooling system analyzer - VAG 1274- or Engine cooling system analyzer - VAG 1274B- through the flexible connection tube.
- With the manual pump of the Engine cooling system analyzer VAG 1274- or Engine cooling system analyzer - VAG 1274B- , generate a pressure of up to 1.6 bar.

With a pressure of ⇒ **Item 13 (page 86)** the safety valve must be opened.

The safety valve must not open.

If the safety valve opens beyond the specified time limit:

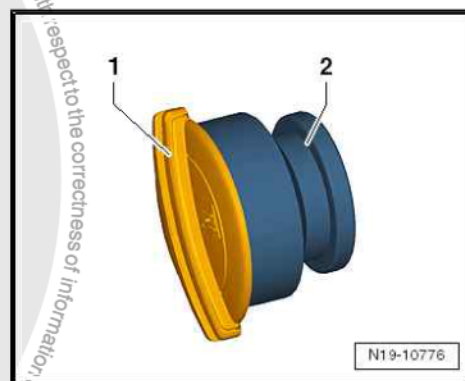
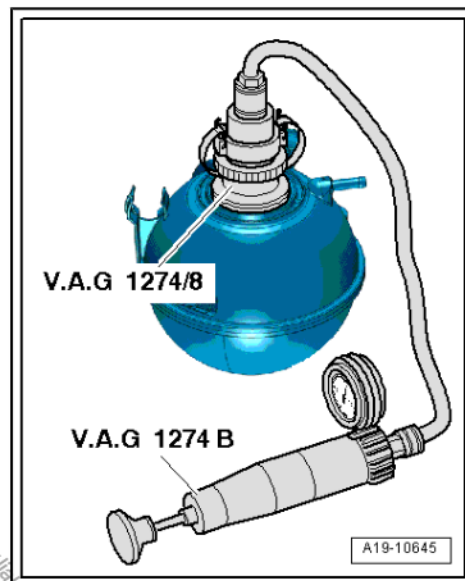
- Replace the coolant tank flap.
- Increase the pressure.

The safety valve must open after exceeding the indicated pressure.

If the safety valve does not open:

- Replace the coolant tank flap.

## 1.6 Radiator - remove and install

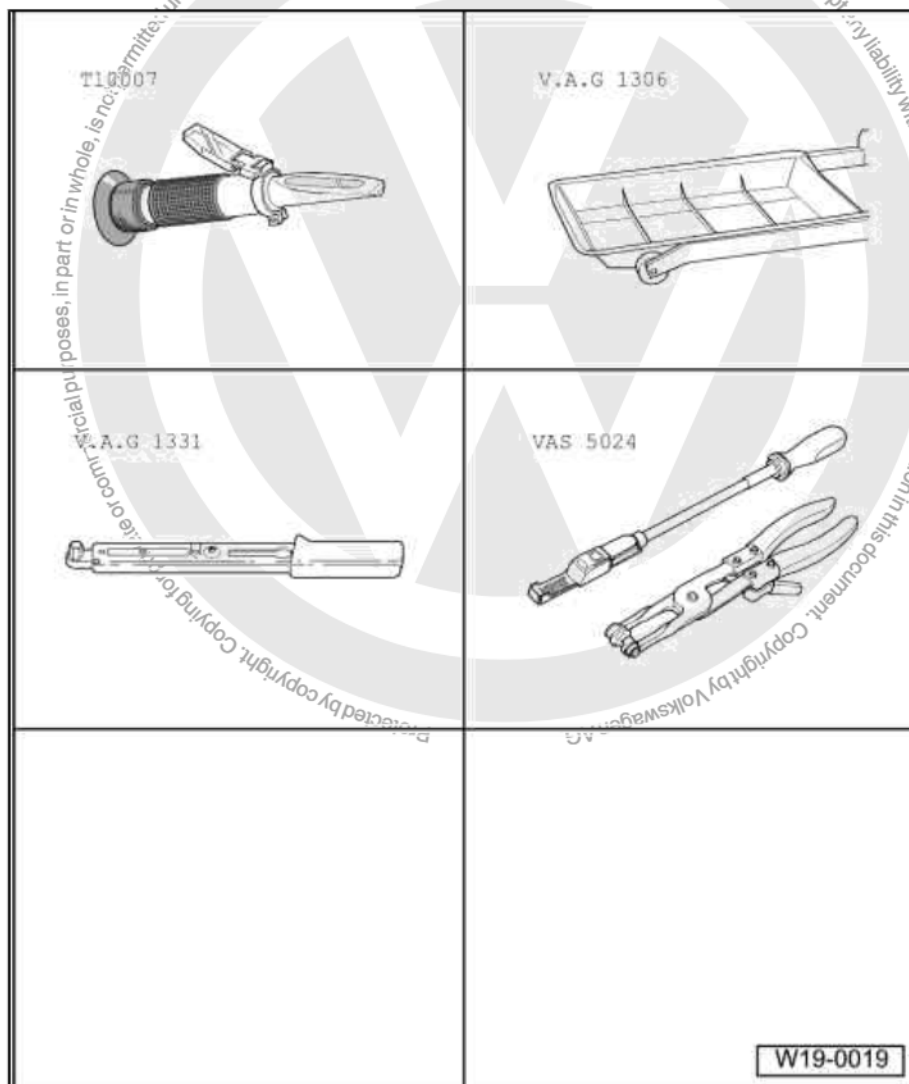






#### Special tools and workshop equipment required

- ◆ Refractometer - T10007A-
- ◆ Oil trap - VAG 1306-
- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ VAS 5024A or Standard-type clamp pliers - VW 5162-



### 1.6.1 Removal

- Remove bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .
- Remove the front end ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - Front section .
- Drain cooling system ⇒ [page 90](#) .
- Loosen quick couplings from the radiator cooling system.
- Remove the radiator fan connector - V7- .
- Loosen the radiator fastening screws and remove the radiator with Radiator fan - V7- .

#### Vehicles with air conditioning

- Observe additional indications and installation works ⇒ [page 100](#) .

### 1.6.2 Installation

Installation is carried out by inverting the removal sequence, observing the following:

- Replenish cooling system ⇒ [page 90](#) .



- Install front end ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - Front section .
- Install bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .

### 1.6.3 Additional notes and installation works in vehicles with air conditioning



#### WARNING

*The cooling gas circuit for the air conditioner should not be opened.*



#### Note

*To prevent faults in the cooling gas hoses and condenser, make sure the hoses are not stretched, bent or crushed.*

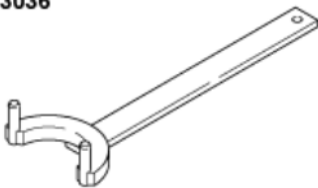
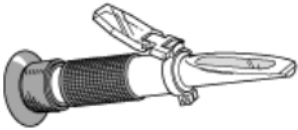
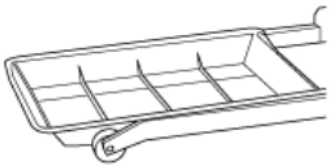

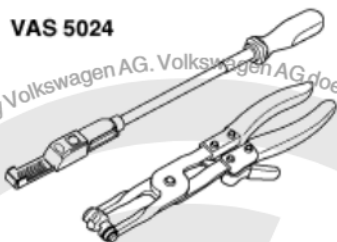
- Loosen cooling gas hose retaining clamp(s).
- Loosen radiator condenser and support it.

### 1.7 Water pump - remove and install



# Special tools and workshop equipment required

- ◆ Special wrench - 3036-
- ◆ Refractometer - T10007A-
- ◆ Oil trap - VAG 1306-
- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2" ) - VAG 1331-
- ◆ VAS 5024A or Standard-type clamp pliers - VW 5162-

<p><b>3036</b></p> 	<p><b>T10007</b></p> 
<p><b>V.A.G 1306</b></p> 	<p><b>V.A.G 1331</b></p> 
<p><b>VAS 5024</b></p> 	<p><b>W19-0036</b></p>



## Note

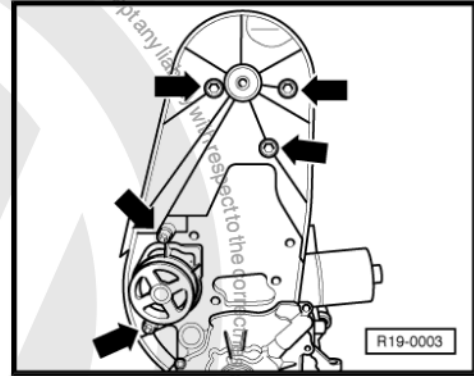
- ◆ *The integrated seal in the water pump must not be separated from the pump.*
- ◆ *In case of faults and leaks, replace the entire pump along with the sealing.*

## 1.7.1 Removal

- Drain cooling system ➔ [page 90](#) .
- Remove toothed belt ➔ [page 45](#) .
- Remove the camshaft gear. To loosen the screw, immobilize the gear with a Special wrench - 3036- .



- Loosen fastening screws -arrows- from the water pump and mechanical distribution rear cover.
- Remove the water pump together with the engine block mechanical distribution rear cover .



## 1.7.2 Installation

Installation is carried out by in reverse order of the removal sequence, whilst observing the following:

- Install the water pump with the mechanical distribution rear cover and tighten the lower fastening bolts. Tightening torque: 20 Nm.
- Tighten the three upper fastening bolts on the mechanical distribution rear cover. Tightening torque: 10 Nm (install with -D/00 600/A2/- ).
- Install the camshaft gear and tighten the new screw (utilize the Special wrench - 3036- ). Tightening torque: 20 Nm + 90°.

Installing the toothed belt and regulating command times

⇒ [page 45](#) .

Replenish the system with new coolant ⇒ [page 90](#) .



## 20 – Fuel supply system

### 1 Fuel supply system components - removal and installation



#### Note

- ♦ *The hose connections are fastened by spring clamps and quick coupling.*
- ♦ *To fasten the fuel hoses to the engine, use spring clamps only. Using tightening or screwed clamps is not allowed.*
- ♦ *To install spring clamps, we recommend using the VAS 5024A or Standard-type clamp pliers - VW 5162- or the Clamp pliers - VAG 1921-.*

Follow safety measures ⇒ [page 106](#) .

Follow cleaning rules ⇒ [page 106](#) .

Removal and installation of the fuel tank ⇒ [page 109](#) .

Removal and installation of accessories and the fuel filter in the fuel tank. ⇒ [page 103](#) .

Repair engine power electronic adjustment parts (electronic accelerator) ⇒ [page 119](#) .

Repair the activated charcoal filter system components ⇒ [page 121](#) .

#### 1.1 Fuel tank components with accessories and fuel filter - removal and installation





1 - Fastening clip

2 - Reservoir lid

3 - Sealing ring

- ❑ Replace it if damaged.

4 - Fastening screw

5 - Compartment lid of the fuel tank nozzle.

- ❑ With rubber boot.
- ❑ Remove and install ⇒ General body repairs, exterior; Rep. gr. 55 Covers .

6 - Vent valve

7 - Gravity valve

- ❑ Remove rear right wheel case protector.
- ❑ Remove the lid for fuel tank nozzle compartment with bellows.
- ❑ Check valve passage continuity. Perpendicular valve: open. Valve inclined 45°: closed.

8 - Fuel supply line

9 - Spring clamp

10 - Fuel reservoir

- ❑ Remove using the Gearbox or engine + gearbox assembly jack or VAG 1383A-EQ 7081- .

- ❑ Remove and install ⇒ [page 109](#) .

11 - 23..0.29 Nm

12 - Lines

- ❑ Anti-choke from fuel tank to the expansion tank.

13 - Lines

- ❑ Vent from fuel tank to the expansion tank.

14 - Bearing

15 - Expansion reservoir

16 - Lines

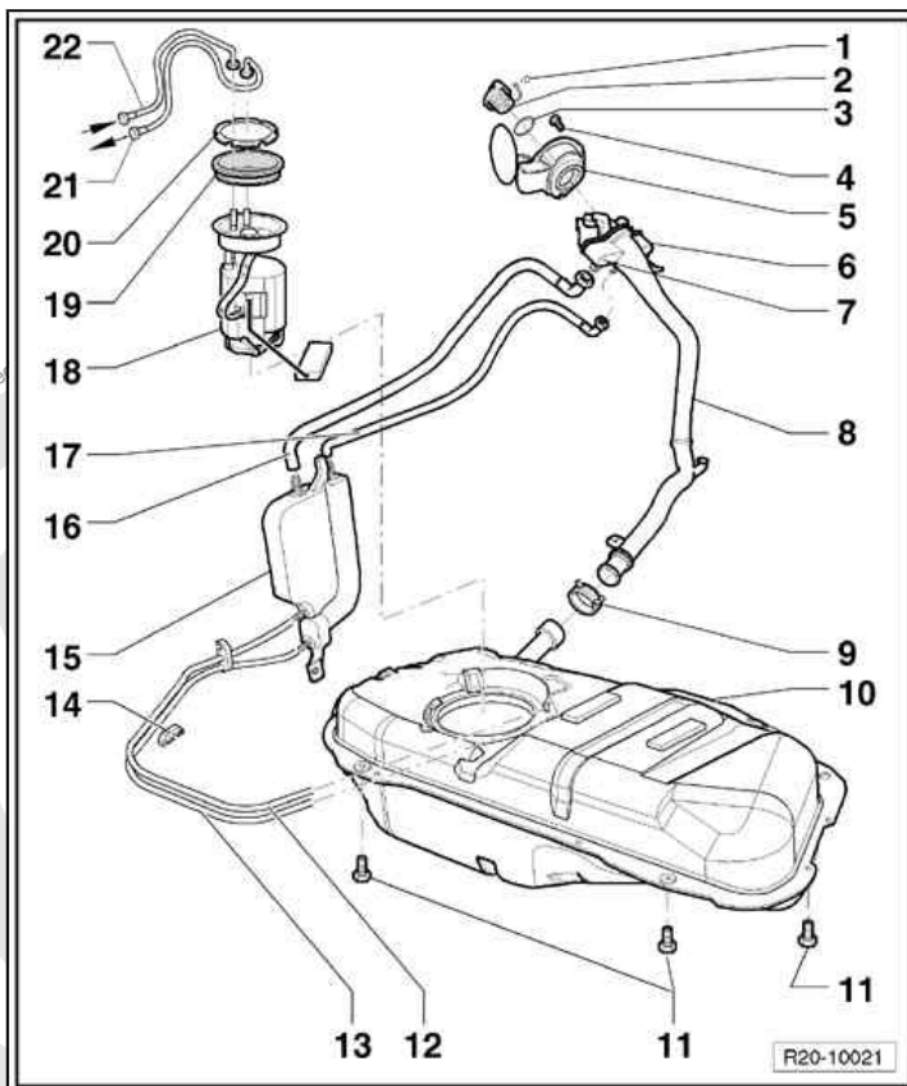
- ❑ Anti-chock for the housing of the supply nozzle of the fuel tank.

17 - Lines

- ❑ Vent for the housing of the supply nozzle of the fuel tank.

18 - Fuel pump (pre-supply pump) - G6-

- ❑ Remove and install ⇒ [page 107](#) .
- ❑ Clean filter, if dirty.
- ❑ Fuel pump (pre-supply pump) - G6- - check ⇒ [page 111](#) .
- ❑ Attention to the installation position in the fuel tank ⇒ [page 105](#)







19 - Seal joint of the Fuel pump (pre-supply pump) - G6-

- ☐ Remove and install ➔ [page 107](#) .
- ☐ Replace.

20 - Circlip (sliding)

21 - Supply tubes

- ☐ Black.
- ☐ Make sure it is well fastened.
- ☐ For fuel distributor.

22 - Return pipes

- ☐ Blue.
- ☐ Fastened laterally to the fuel reservoir.
- ☐ Make sure it is well fastened.

1 - For the housing of the supply nozzle of the fuel tank.

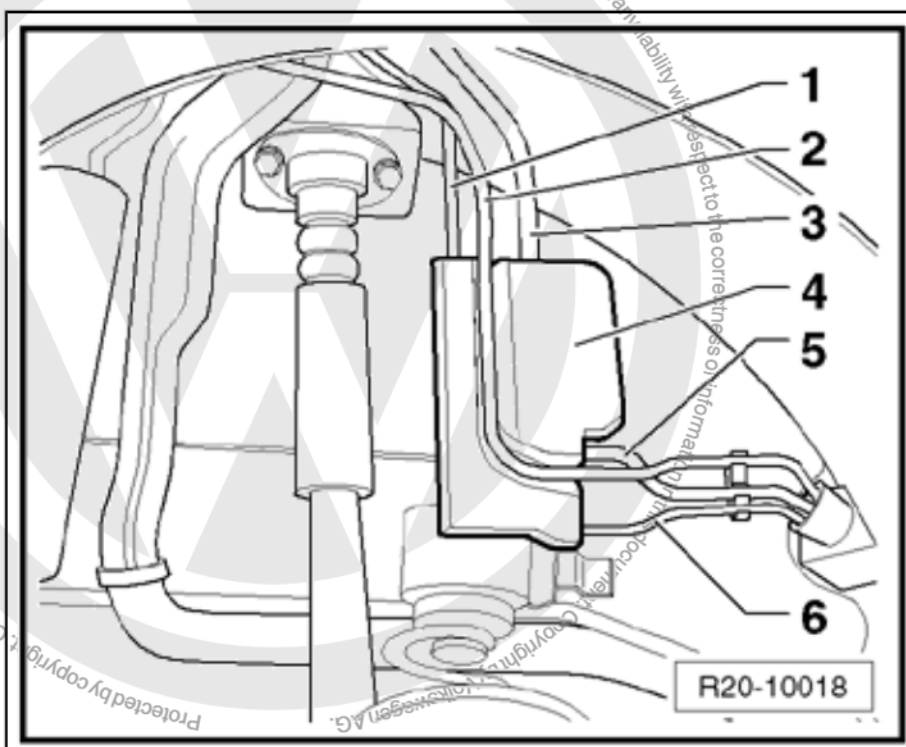
2 - For activated charcoal filter.

3 - For the housing of the supply nozzle of the fuel tank.

4 - Expansion reservoir

5 - For expansion tank.

6 - For expansion tank.



Installation position of the Fuel pump (pre-supply pump) - G6-flange

The arrow on the Fuel pump (pre-supply pump) - G6- must match the yellow dot on the right side of the body.

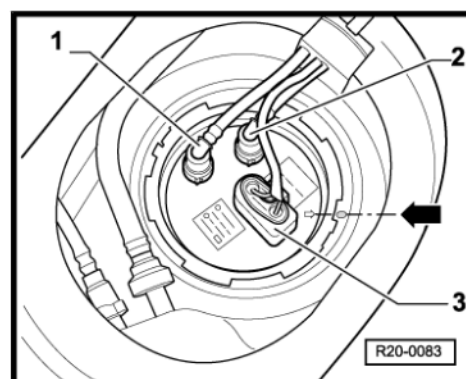
Blue return lines -1- in the connection.

Supply lines -2- in the connection.

Electrical connector of the Fuel pump (pre-supply pump) - G6-3-.



Note



*After installing the Fuel pump (pre-supply pump) - G6- check if inlet, return and vent pipes are still fastened to the fuel reservoir.*



### Check the vent valve

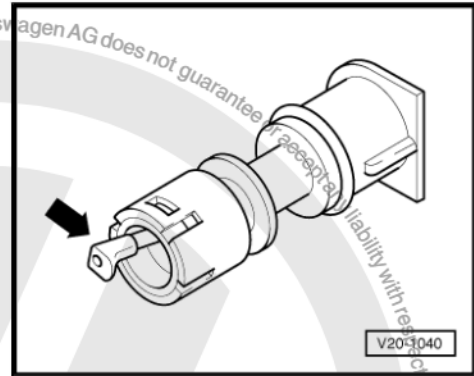
Lever in the resting position: closed.

Lever pushed in the arrow direction: open.



#### Note

Before vent valve installation, remove fuel reservoir lid.



## 1.2 Safety measures regarding work on the fuel supply systems



### WARNING

Remember the following when performing assembly work, especially inside the engine compartment where there is little space:

- ◆ All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling fluid and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.
- ◆ Allow easy access to all the moving or hot parts.

While removing or installing the Fuel level indicator sensor - G6- or Fuel pump (pre-supply pump) - G6- , when the fuel reservoir is full or partially full, observe the following:



### WARNING

Fuel supply hose is under pressure. Before loosening hose connection points, place a cloth around it. Next, eliminate pressure by carefully removing hose.

- ◆ Before starting installation work, place the suction hose of a gas extraction device near the fuel tank opening in order to extract to absorb gases released by the fuel. If an extracting device is unavailable, use a radial fan (the engine must be out of air flow) with rate of air displacement greater than 15 m<sup>3</sup>/hour.
- ◆ Avoid skin contact with fuel! Wear fuel resistant gloves!
- ◆ For safety reasons, before opening the system, remove fuse number. 33 of the Fuel pump (pre-supply pump) - G6- .

## 1.3 Cleaning rules

For cleaning, carefully observe these "5 rules" when working on the fuel supply/injection system:

- ◆ Thoroughly clean the connections and surrounding areas before disconnecting them.
- ◆ Place parts on clean surface and cover them. Use lint-free cloths!
- ◆ If the repair work will not be performed immediately, exposed components must be covered or carefully preserved.

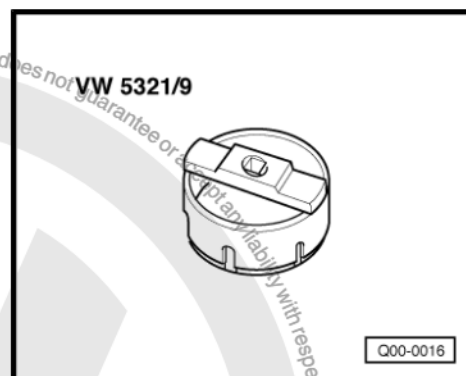


- ◆ Install clean components only. Remove spare parts from packaging just prior to installation. Do not install components that have been stored outside of packaging (i.e. inside a tool box, etc.).
- ◆ With the system open: Avoid using compressed air, if possible. Do not move vehicle, if possible.

## 1.4 Fuel pump (pre-supply pump) - G6- - remove and install

Special tools and workshop equipment required

- ◆ Wrench or T 10334 - VW 5321/9-



- ◆ Torque meter - 40 to 200 Nm ( enc. 1/2") - VAG 1332-



### 1.4.1 Removal

- Take safety precautions before starting removal ⇒ [page 106](#).
- Follow cleaning rules ⇒ [page 106](#).
- Check if the vehicle has code radio; if so, request respective anti-theft code.
- With ignition off, disconnect earth strap from the battery.
- Fold rear seat forward.
- Remove the Fuel pump (pre-supply pump) - G6- access cover.



#### WARNING

*Fuel supply hose is under pressure. Before loosening hose connection points, place a cloth around it. Next, eliminate pressure by carefully removing hose.*

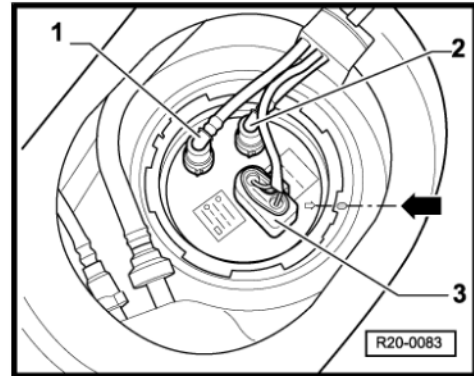


- Remove the return -1-, and supply -2- lines and the connector -3- from the flange.



#### Note

To remove fuel hoses, press the safety ring located under the connection.

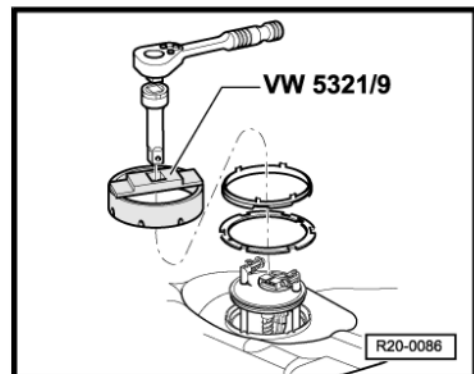


- Remove the lock with a Wrench or T 10334 - VW 5321/9- .
- Remove the Fuel pump (pre-supply pump) - G6- and the seal from the fuel tank opening.



#### Note

In case of replacing Fuel pump (pre-supply pump) - G6- , empty the old Fuel pump (pre-supply pump) - G6- before disposing it.



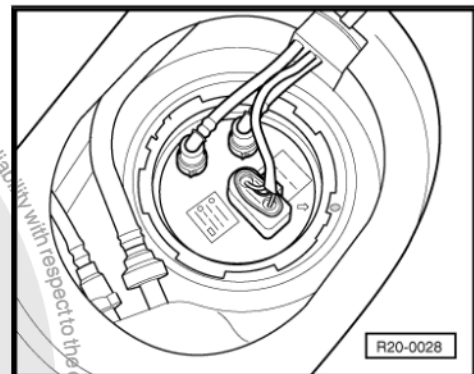
## 1.4.2 Installation

- The Fuel pump (pre-supply pump) - G6- should be installed in reverse order of removal.



#### Note

- ◆ Try not to bend the Fuel level indicator sensor - G- during installation.
- ◆ Put the new sealing ring of Fuel pump (pre-supply pump) - G6- in dry condition on fuel reservoir opening.
- ◆ Lubricate seal using fuel merely for the purpose of installing the Fuel pump (pre-supply pump) - G6- .
- ◆ Observe the installation of the Fuel pump (pre-supply pump) flange - G6- -arrow-: The flange mark must match the body mark.
- ◆ Check that the fuel hoses are firmly connected.
- ◆ Do not confuse the supply and return hoses.
- ◆ After installation of the Fuel pump (pre-supply pump) - G6- , check whether the supply, return and vent pipes are still fastened to the fuel reservoir.



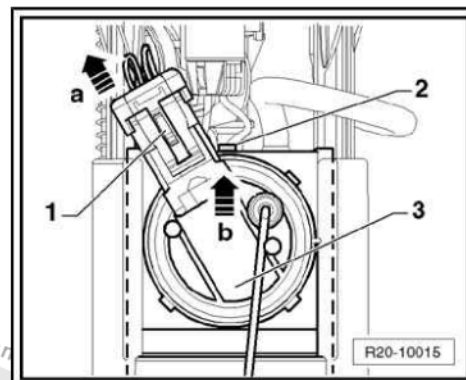
## 1.5 Fuel level indicator sensor - G- - removal and installation

### 1.5.1 Removal

- Remove Fuel pump (pre-supply pump) - G6- ➔ [page 107](#) .



- Disconnect the connector from the Fuel level indicator sensor - G- by displacing the lock -1- and moving the connector in direction of -arrow a-.
- Press lock -2- and move the Fuel level indicator sensor - G- -3-upwards-arrow b-.



### 1.5.2 Installation

- Position the Fuel level indicator sensor - G- on the Fuel pump (pre-supply pump) - G6- guides and press it downwards until it fits.
- Install the Fuel level indicator sensor - G- connector.

### 1.6 Fuel reservoir - remove and install

Special tools and workshop equipment required

- ◆ Torque meter - 5 to 50 Nm ( enc. 1/2") - VAG 1331-

V.A.G 1331



W00-11166

- ◆ Gearbox or engine + gearbox assembly jack or VAG 1383A set - EQ 7081-

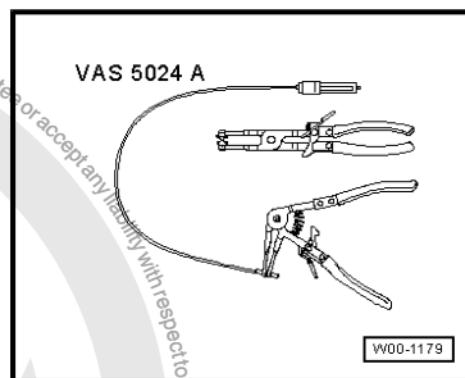
V.A.G 1383 A



W00-11135



- ◆ VAS 5024A or Standard-type clamp pliers - VW 5162- or Pliers - VAG 1921-



## 1.6.1 Removal

### Conditions

- The fuel tank must only be half full.



### Note

- ◆ Empty the fuel tank with a Fuel aspirator and tank - VAS 5190- .
- ◆ Take safety precautions before starting removal ⇒ [page 106](#) .
- Check whether the vehicle has a coded radio. If so, request the anti-theft code.
- With ignition off, disconnect earth strap from the battery.
- Remove the tank cap.
- Empty the fuel tank and clean around the filling nozzle.
- Fold rear seat forward.
- Remove the Fuel pump (pre-supply pump) - G6- access cover.
- Disconnect the 4-pole connector from the flange.
- Remove the fuel tank hoses near the Fuel pump (pre-supply pump) - G6- .
- Loosen the exhaust system. The exhaust system must be fastened to the body with wire, slightly lowered.
- Remove the heat deflector between the exhaust and the fuel tank.

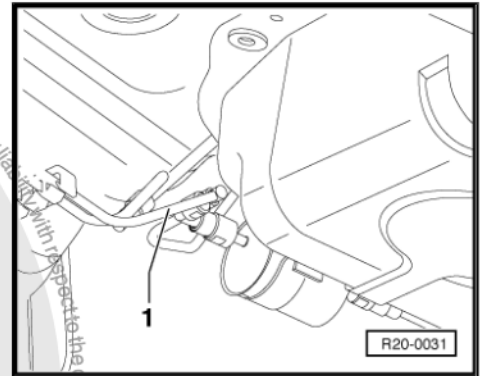




- Loosen supply hose -1- from the filter.
- Remove the clamp from supply line near the tank with VAS 5024A or Standard-type clamp pliers - VW 5162- or Pliers - VAG 1921- .
- Remove fastening screws, supporting the fuel tank with the Transmission jack or engine + transmission or VAG 1383A set. EQ 7081- .
- Lower the fuel tank.

**WARNING**

*Fuel supply hose is under pressure. Before loosening hose connection points, place a cloth around it. Next, eliminate pressure by carefully removing hose.*



## 1.6.2 Installation

Installation is carried out in reverse order of removal, whilst considering the following:

- ◆ Attach the ventilation and fuel hoses without bending them.
- ◆ Check that the fuel hoses are firmly connected.

**Note**

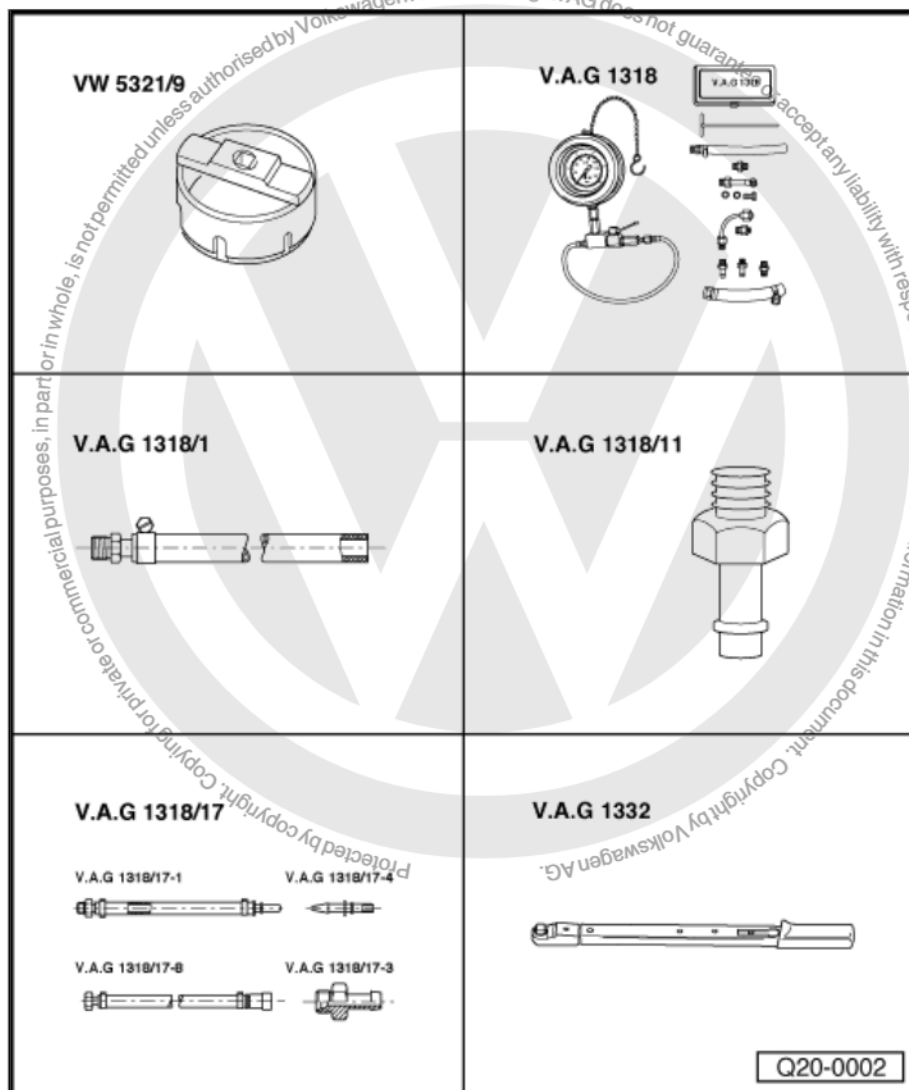
*Once the fuel tank is installed, check that the supply, return and ventilation hose assemblies are still attached.*

## 1.7 Fuel pump (pre-supply pump) - G6- - check



## Special tools and workshop equipment required

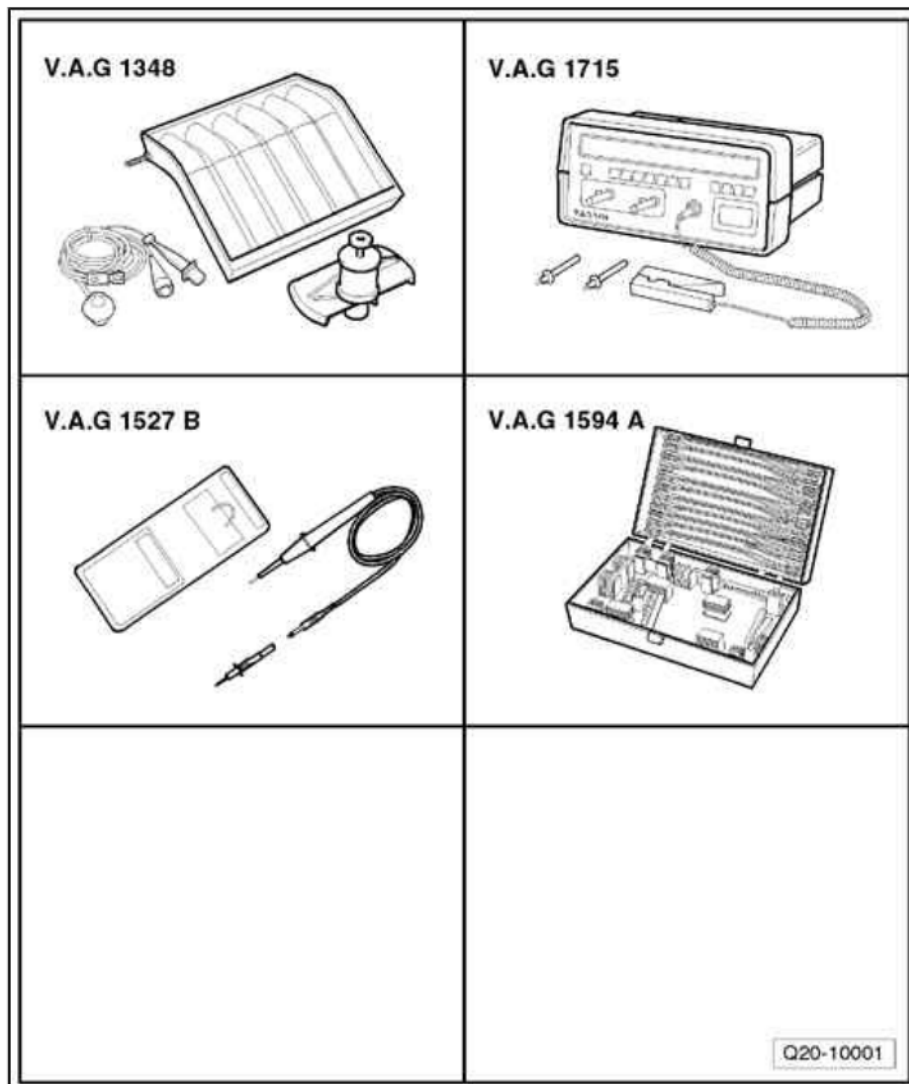
- ◆ Wrench or T 10334 - VW 5321/9-
- ◆ Pressure gauge - VAG 1318-
- ◆ Adapter - VAG 1318/1-
- ◆ Adapter - VAG 1318/11-
- ◆ Adapter - VAG 1318/17-
- ◆ Torque meter - 40 to 200 Nm (enc. 1/2") - VAG 1332-
- ◆ Flow meter - VAG 1348-





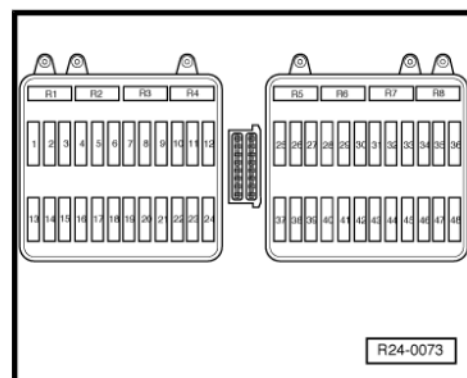
### Special tools and workshop equipment required

- ◆ Adapting cable - VAG 1348/3-2-
- ◆ Test probe - EQ 7300- or Test probe - VAG 1527B-
- ◆ Auxiliary measuring set - VAG 1594A-
- ◆ Multimeter - VAG 1715-
- ◆ -Recipiente graduado-
- ◆ ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



### Check conditions

- Fuse number 33, OK.
- Battery voltage, 11.5 V minimum.
- All electrical components, such as lights and the rear wind-screen demister, must be turned off.
- If the vehicle is equipped with air conditioning, it should also be off.





## 1.7.1 Operation of the electrical supply - check



### Note

*In the following operations sequence, it may be possibly necessary to turn off the ground strap from the battery. Therefore, check if a code radio is installed. Should that be the case, first obtain the anti-theft code.*

- Tilt rear seat forwards.
- Remove the cover beneath the seat.
- Turn on the ignition. The Fuel pump (pre-supply pump) - G6- must operate in an audible way for approx. 1 second.

If the Fuel pump (pre-supply pump) - G6- does not work:

- Turn ignition off.
- Remove the fuse box lid.
- Remove fuse 33 from the ( Fuel pump (pre-supply pump) - G6- ) fuse box.
- Connect the Remote control - VAG 1348/3A- and Adapter cable - VAG 1348/3-2- to the right contact of fuse 33 to activate the Fuel pump (pre-supply pump) - G6- and to the positive terminal of the Battery (+).
- Activate the remote control.

If the Fuel pump (pre-supply pump) - G6- works:

- Check the operation of the Fuel pump relay - J17- , according to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

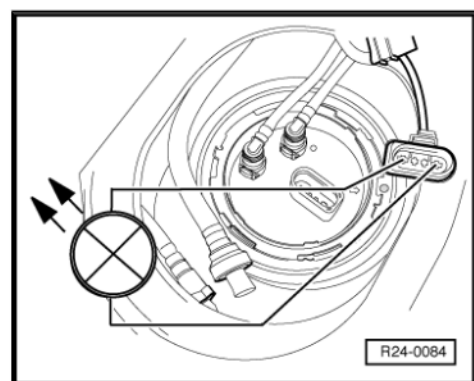
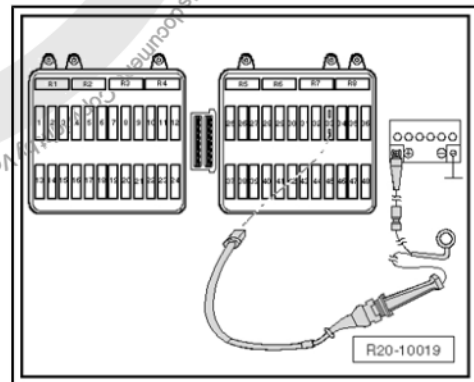
If the Fuel pump (pre-supply pump) - G6- does not work:

- Disengage the 4-poles connector from Fuel pump (pre-supply pump) - G6- .
- Couple the Test probe - EQ 7300- or Test probe - VAG 1527B- with Auxiliary cables - VAG 1594A- with Auxiliary cables to the external contacts of the connector.
- Activate the remote control.

The LED should light up.

- If the LED does not light up:
- Locate and eliminate cable interruption, according to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

The LED lights up (correct power supply):

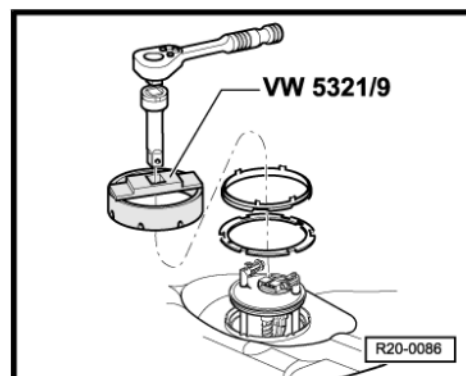




- Remove the Fuel pump (pre-supply pump) - G6- with a Wrench - VW 5321/9- or Wrench - T10334- .
- Check if the cables are coupled to the Fuel pump (pre-supply pump) - G6- .

In case there is no cable interruption:

- Fuel pump (pre-supply pump) - G6- damaged, replace.



## 1.7.2 Fuel flow - check

### Check conditions

- The Fuel pump (pre-supply pump) - G6- supply does not display any irregularities.
- Remote control - VAG 1348/3A- installed.
- Fuel pressure regulator and Fuel pump (pre-supply pump) pressure in order ➔ [page 138](#) .

### Checking process



#### Note

*The fuel flow is measured at 3.0 bar. For this reason fuel pressure must be checked before measuring the flow.*

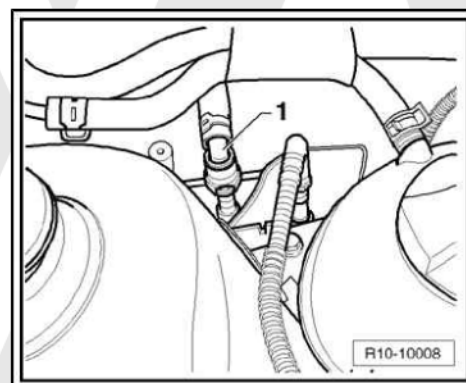
- Remove fuel filling nozzle cap.



#### WARNING

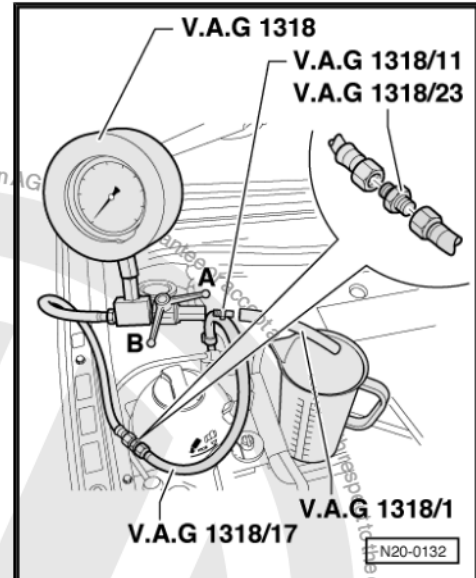
*Fuel supply hoses are under pressure. Wrap hose connection with cloth prior to loosening. Next, eliminate pressure by disassembling hose carefully.*

- Disconnect fuel supply pipes connection -1- and clean spilled fuel with a cloth.
- Couple the Pressure gauge - VAG 1318- to the fuel supply tube, using the adaptors Connector - VAG 1318/23- and Adaptor - VAG 1318/17- .





- Couple the hose of the Pressure Gauge - VAG 1318- to the Adaptor - VAG 1318/11- and Adaptor - VAG 1318/1- from the verification Pressure Gauge - VAG 1318- and place its end in a 3.0 l flask.
- Open the Pressure gauge - VAG 1318- valve. The lever will indicate the flow direction -A-.
- Activate the Remote control - VAG 1348A-, and close the valve slowly, until the Pressure gauge - VAG 1318- indicates a positive pressure of 3.0 bar. From this moment on, do not change the position of the valve.
- Empty measuring container.
- The flow of the Fuel pump (pre-supply pump) - G6- depends on the battery voltage. For such, connect the Multimeter - VAG 1715- to the battery of the vehicle, using the Auxiliary Cables - VAG 1594A-.
- Activate the Remote control - VAG 1348A- for 30 seconds, measuring the battery voltage.



- Compare the fuel flow with the theoretical value.

8) Minimum amount  $\text{cm}^3/30 \text{ s}$

9) Voltage in the Fuel pump (pre-supply pump) - G6- with engine stopped and pump operating (approx. 2 volts less than battery voltage).

Examples of readings:

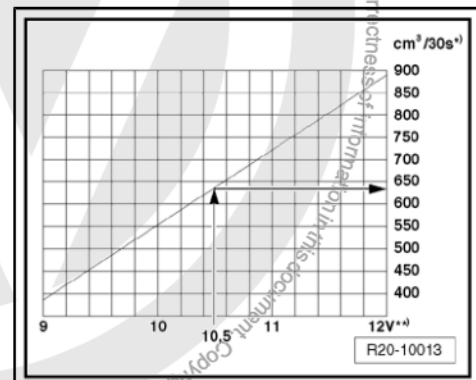
During the test, a voltage of 12.5 volts is measured in the Battery. As the Fuel pump (pre-supply pump) - G6- voltage is approximately 2 V lower than in the battery, the result is a supply flow of at least  $633 \text{ cm}^3/30 \text{ s}$ .

If minimum flow is not achieved:

- Check if the supply pipes to the filter present folds or obstructions.

If fuel pipes are in order.

- Check fuel flow before fuel filter.



#### WARNING

*Fuel supply pipes are under pressure! Before loosening hose connections, put a cleaning cloth on connection points. Then depressurize by carefully pulling the hose.*



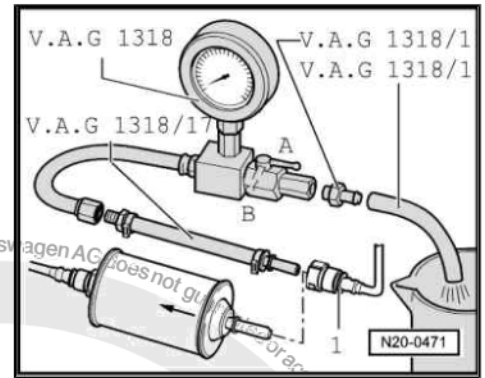
#### Note

*Press the keys on hose latches.*





- Remove the supply hose -1- from the fuel filter inlet and connect it to Adapting set - VAG 1318/17- .
- Pressure gauge - VAG 1318- with Adapting set - VAG 1318/17- as shown.
- Install the adapter - V.A.G 1318/16- on the adapter - V.A.G 1318/11- for the Pressure gauge and put its end in a graduated container with at least 3.0-litre capacity.
- Open the pressure gauge valve. The key points towards the fuel passage-A-.
- Adapting cable - VAG 1348/3A- . Actuate the Remote control - VAG 1348/3A- , close the valve slowly until the Pressure gauge - VAG 1318- indicates 3.0 bar. Do not change the valve position.
- Empty measuring container.
- Check flow again.
- Activate the Remote control - VAG 1348/3A- once more for 30 seconds. Compare the flow value with the one obtained in the first measurement.



If minimum flow is not achieved:

- Remove the Fuel pump (pre-supply pump) - G6- and check whether there is dirt in the screen filter.

If minimum flow is achieved:

- Replace fuel filter.

If the minimum flow is not reached again:

Only if no irregularities have been found so far:

- Fuel pump (pre-supply pump) - G6- - damaged, replace it [⇒ page 107](#) .

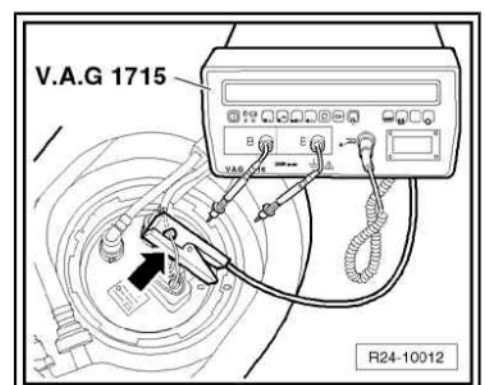
If the desired fuel flow is achieved, but at great cost, we may conclude that the fuel supply presents some irregularity (i.e.: temporary fuel supply failure):

- Reconnect the fuel line that have been removed.

- By using the electric calliper, connect the Multimeter - VAG 1715- to contact 1, 4-pole connection cable (blue/white) -arrow- on cable harness.
- Run the engine and idle it.
- Measure current draw by the Fuel pump (pre-supply pump) - G6- . Theoretical value: 6.8 amps max.

If the current draw is excessive:

- Fuel pump (pre-supply pump) - G6- - damaged, replace it [⇒ page 107](#) .



### 1.7.3 Check Fuel pump (pre-supply pump) - G6- retention valve

Check conditions

- Adapting cable - VAG 1348/3A- and Adapting cable - VAG 1348/3-2- connected.



## Checking process



### WARNING

*Fuel supply pipes are under pressure! Before loosening hose connections, put a cleaning cloth on connection points. Then depressurize by carefully pulling the hose.*



### Note

*This test should confirm simultaneously tightness of fuel supply lines set joints, from the fuel pump (pre-supply pump) up to the location of the Pressure gauge - VAG 1318- junction.*

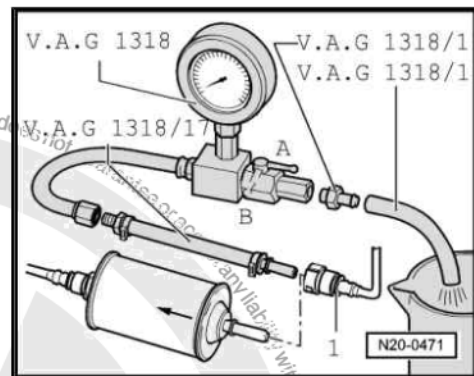
- Remove supply hose -1- from fuel filter inlet and connect it to the Adapting set - VAG 1318/17- and the Pressure gauge - VAG 1318- .
- Install the Adapter - VAG 1318/16- on the Adapter - VAG 1318/11- of the pressure gauge and put the hose end in a graduated container with a 3-litre capacity.



### Note

*For that, press the keys on hose connectors.*

- Close the valve on the Pressure gauge - VAG 1318- (valve transverse regarding the flow direction - position -B-) .
- Activate the Remote control - VAG 1348/3A- in quick consecutive intervals, until reaching a pressure of approx. 3.0 bar.



### WARNING

*Risk of splashes when opening the passage key; keep a container in front of the free end of the Pressure gauge - VAG 1318- .*

- Reduce excess pressure by carefully opening the valve.
- Check the pressure drop on the Pressure gauge - VAG 1318- . After 10 minutes, the pressure should not drop below 2.5 bar.

If the pressure keeps dropping:

- Check hose connections for leaks.

If no irregularities are found in the cables:

- Fuel pump (pre-supply pump) - G6- - damaged, replace it  
⇒ [page 107](#) .



## 2 Engine power electronic adjustment (electronic accelerator)

Operation ➤ [page 119](#) .

Engine power electronic adjustment (electronic accelerator) -  
check ➤ [page 119](#) .

### 2.1 Operation

In the electronic accelerator, the throttle valve is not activated by a cable. There is no mechanical connection between the accelerator and the throttle valve.

The position of the accelerator is transmitted to the Engine control unit - J623- by two accelerator position sensors (variable resistance; stored in a housing), which are connected to the accelerator.

The position of the accelerator (at the driver's criterion) is the main input value for the Engine control unit - J623- .

The throttle valve is activated by an electric engine (butterfly element) incorporated to the Throttle valve control unit - J338- , in all load and rotation intervals.

The throttle valve is activated by a butterfly element, according to data provided by the Engine control unit - J623- .

With the engine turned off and the ignition connected, the Engine control unit - J623- activates the butterfly element, due to the data provided by the Accelerator pedal position sensor - G79- . This means that if the accelerator is half activated, the butterfly element will open proportionally, that is, the throttle valve will be half opened.

With the engine running (loaded), the Engine control unit - J623- may open or close the butterfly, regardless of the Accelerator pedal position sensor - G79- .

Accordingly, the throttle valve may, for instance, be completely open already, even if the accelerator is only half activated. The benefit is being able to avoid losses from choking, caused by the throttle valve.

Furthermore, this enables lower fuel consumption and emissions of pollutants for certain load conditions.

The necessary torque may be obtained by the Engine control unit - J623- , through an optimal combination between the throttle valve opening and the over-supply pressure.

Believing that the "electronic accelerator" comprises only one or two components would be a mistake. The electronic accelerator is a system comprised of all the components that contribute to determining the position of the butterfly valve, in order to adjust it and activate it, such as for example, the Accelerator pedal position sensor - G79- , the Accelerator butterfly valve command unit - J338- , the "E-gas" system fault warning light - K132- , the Engine control unit - J623- , etc).

### 2.2 Engine power electronic adjustment (electronic accelerator) - check



1 - Pedal support

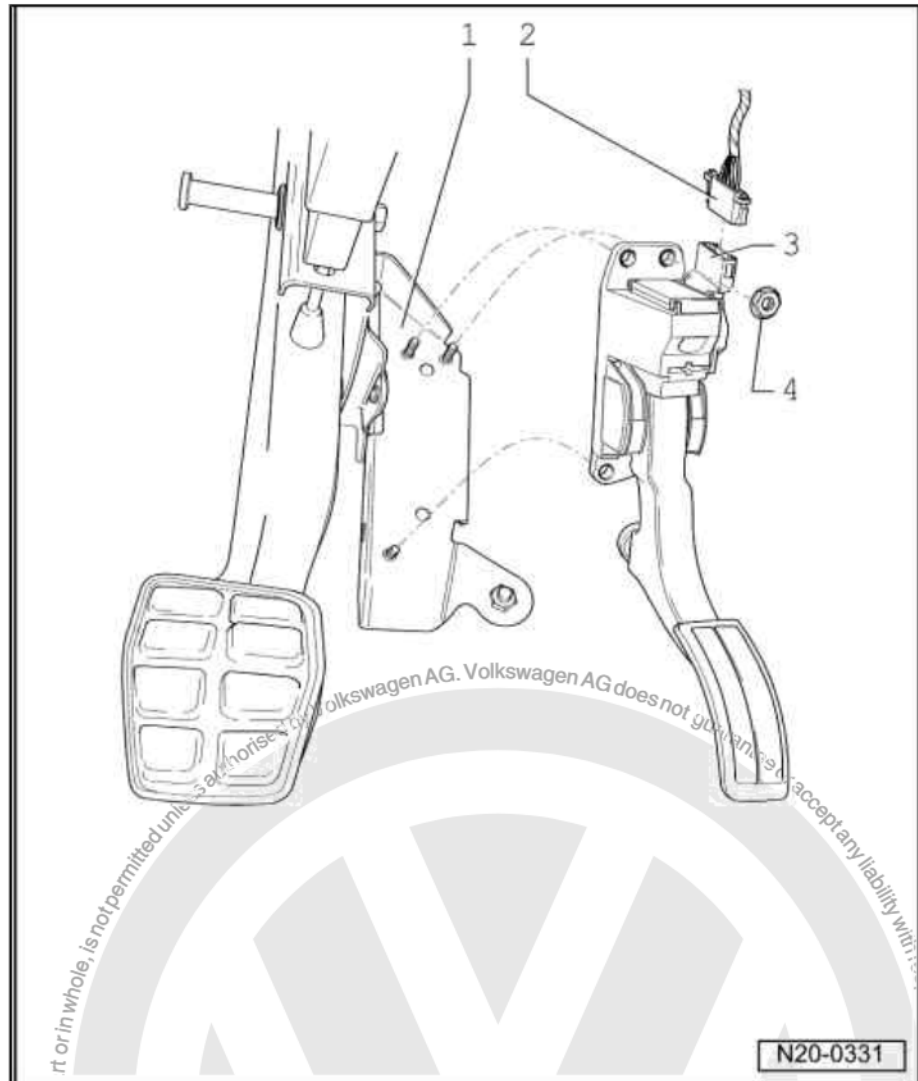
2 - Connector

❑ Black, 6 poles

3 - Accelerator pedal position sensor - G79- and Accelerator pedal position sensor 2 - G185-

❑ To remove, loosen the connections and disconnect the connector.

4 - 10 Nm





## 3 Activated charcoal filter system

### 3.1 Operation

Depending on the local air temperature and pressure, fuel vapours may form over the surface of the fuel in the tank.

The activated charcoal filter system prevents these hydrocarbon emissions from reaching the air we breathe.

Limited amounts of fuel vapours reach the activated charcoal filter, located in the highest point of the tank, through a gravity valve (which closes at a 45° inclination) and the pressure retention valve.

The activated charcoal absorbs these vapours like a sponge.

During the vehicle operation and with the lambda adjustment active (hot engine), the Magnetic valve 1 for the activated charcoal filter - N80- , also known as regeneration valve, is activated cyclically by the engine control unit, in function of its load and engine speed (rpm) regime. The opening interval depends on the input signals.

Intake manifold vacuum aspirates fresh air through the ventilation opening on the lower part of the activated charcoal filter during the purging procedure (activated charcoal regeneration). The fuel vapours stored in the activated charcoal and the fresh air are fed for combustion in controlled quantities.

The pressure retention valve prevents the fuel vapours from being aspirated directly from the tank, when the Magnetic valve 1 for activated charcoal filter - N80- opens and there is a vacuum in the intake manifold. Accordingly, this ensures priority drainage for the activated charcoal filter.

In the absence of current (e.g. harness interruption), the electromagnetic valve remains closed. The activated charcoal filter will not be purged.



#### Note

- ◆ *Hose connections are fastened by spring clamps.*
- ◆ *To install spring clamps, we recommend using the VAS 5024A or Standard-type clamp pliers - VW 5162- .*

Follow applicable safety measures ⇒ [page 106](#) .

Follow applicable cleaning rules ⇒ [page 106](#) .

### 3.2 Activated charcoal filter system components - repair



**1 - Fuel vapours tubing**

- ☐ Make sure it is well fastened.

**2 - Pressure retention valve with connection hose**

- ☐ Make sure it is well fastened.
- ☐ From the gravity valve in the fuel reservoir.

**3 - Activated charcoal filter**

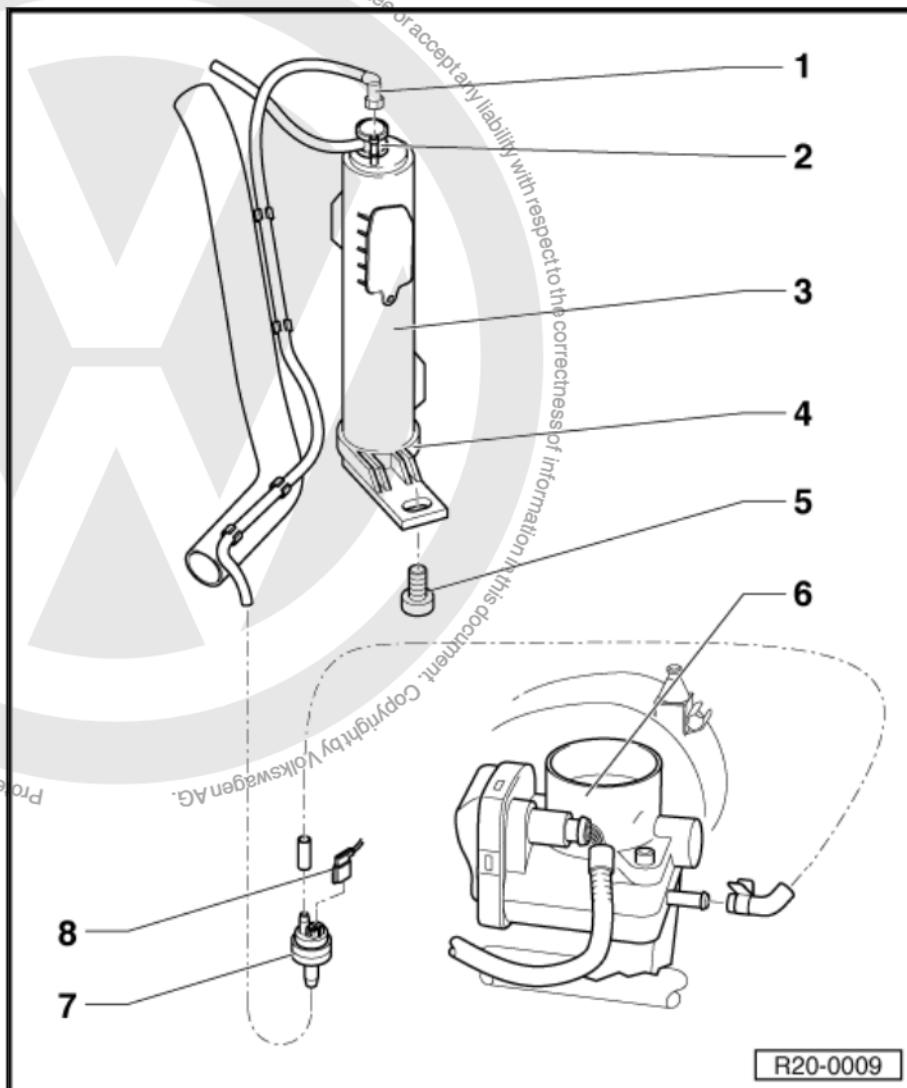
- ☐ Installation location: in the right rear wheel case.

**4 - Vent connection**

- ☐ Visible from below.

**5 - 10 Nm****6 - Intake manifold with Throttle valve control unit - J338-****7 - Magnetic Valve I for activated charcoal filter - N80-**

- ☐ The valve will close when the ignition is off.
- ☐ The valve is activated (by pulses) by the Engine control unit - J623-, when the engine is at service temperature.

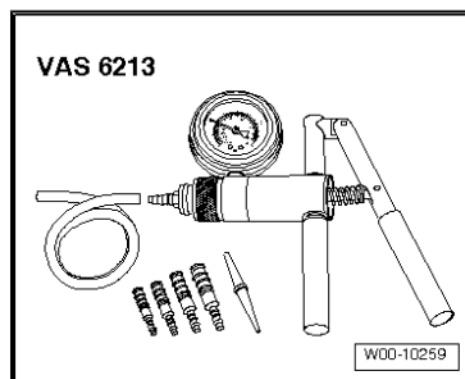
**8 - Connector**

R20-0009

**3.3 Fuel tank ventilation - check**

Special tools and workshop equipment required

- ♦ Vacuum pump - VAG 1390- or Vacuum pump - VAS 6213-

**3.3.1 Test conditions**

- The ignition must be OFF.





### 3.3.2 Test sequence

- Remove the regenerations flexible hose -1- from the activated charcoal filter on the electromagnetic valve 1 for the activated charcoal filter - N80- -2-.
- Install the Vacuum pump - VAG 1390- or Vacuum pump - VAS 6213- as illustrated, the flexible hose -1-.
- Operate the Vacuum pump - VAG 1390- or Vacuum pump - VAS 6213- several times. Vacuum can not be generated.

If vacuum is generated:

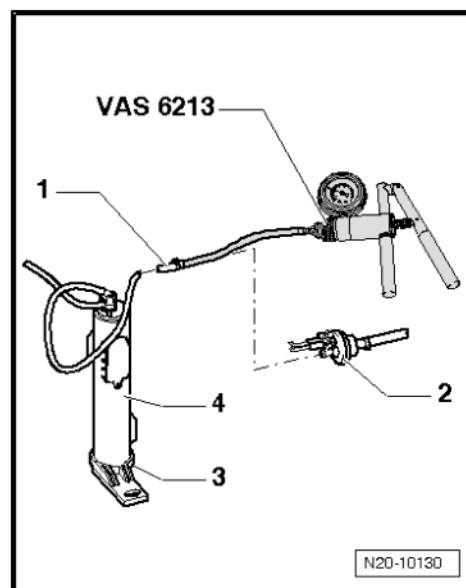
- Check ventilation opening -3- in the lower part of the activated charcoal filter -4- as for impurities and clean, if necessary.

If vacuum is not generated:

- Block ventilation opening -3- and run the vacuum pump several times again. Vacuum must be generated.

If vacuum is not generated:

- Replace the activated charcoal filter.





## 24 – Mixture preparation - injection

### 1 Injection system - repair

#### 1.1 General instructions regarding the injection system

- ◆ The Engine control unit - J623- is equipped with a self-diagnosis system. Before carrying out repairs, and for trouble-shooting, refer to the event memory. Likewise, check vacuum hoses and connections (air infiltration).
- ◆ The fuel hoses in the engine compartment must only be secured with spring clamps. Using retaining clamps or screwed clamps is not allowed.
- ◆ A minimum voltage of 11.5V is necessary for the perfect operation of electrical components.
- ◆ Do not use silicone-based sealants. Silicone residues sucked in by the engine do not burn and may damage the Lambda Probe - G39- .

Safety measures ⇒ [page 133](#) .

Cleaning rules ⇒ [page 134](#) .

Technical data ⇒ [page 134](#) .

#### 1.2 Component location

Components A to D are not represented in the illustration.





A - Brake pedal switch - F47-  
or Brake light switch - F-

- ☐ Together in one case, in the feet compartment, on the brake pedal.

B - Accelerator pedal position sensor - G79- Accelerator pedal position sensor 2 - G185-

- ☐ At the feet compartment, on the accelerator pedal.

C - Clutch pedal switch - F36-

- ☐ In feet compartment, on clutch pedal.

D - Fuel pressure regulator

- ☐ On the Fuel pump (pre-supply pump) - G6- .

1 - 3 poles connector

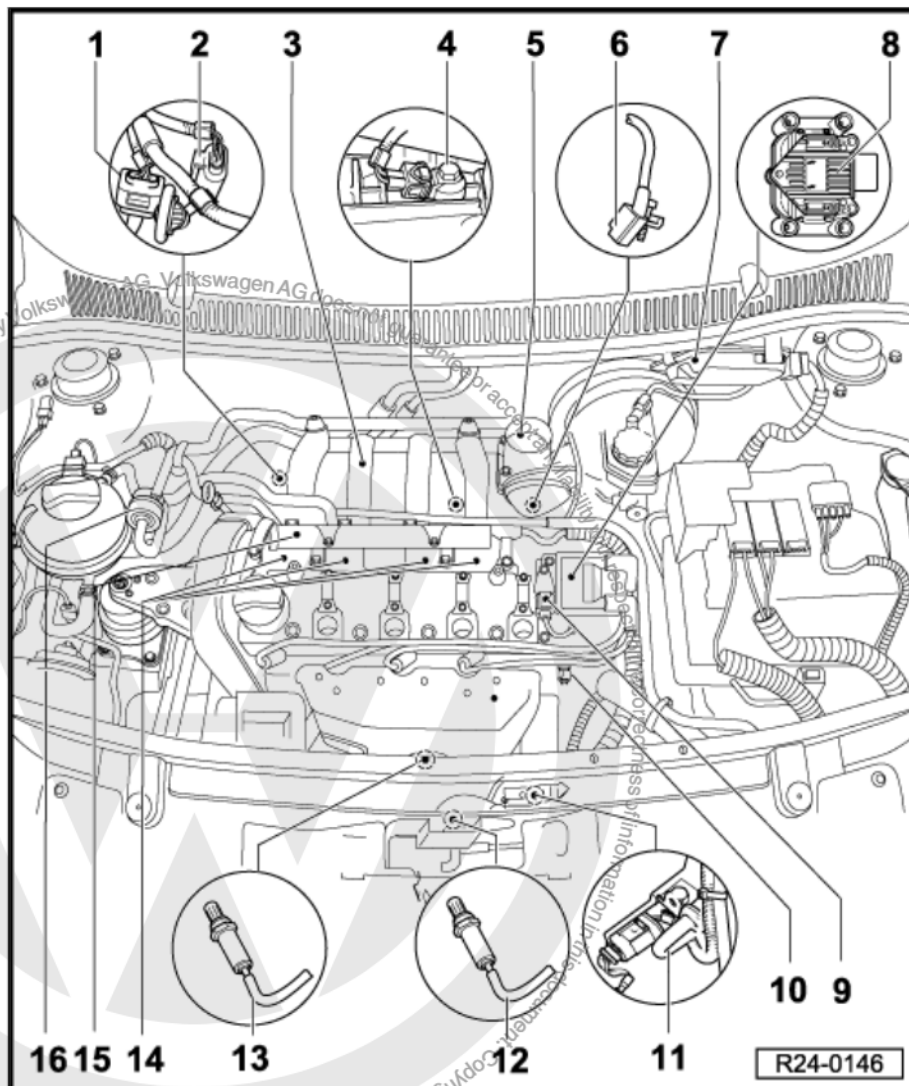
- ☐ Black.
- ☐ To the Engine speed sensor - G28- .

2 - 4 poles connector

- ☐ Black.
- ☐ To the Intake manifold pressure sensor - G71- with the Air intake temperature sensor - G42- .

3 - Intake manifold

- ☐ Remove and install





⇒ [page 131](#) .

4 - Knock sensor 1 - G61-

- ☐ Installation location. On the engine block, intake side.

5 - Throttle valve control unit - J338-

6 - Engine speed sensor - G28-

- ☐ Installation location: In the crankshaft flange (flywheel side).

7 - Engine control unit - J623-

- ☐ Fit or remove the connector only with ignition switched off.
- ☐ Unlock to loosen.

8 - Ignition transformer - N152-

- ☐ With codes for ignition cables, do not confuse.
- ☐ ⇒ [Item 2 \(page 153\)](#) .

9 - Hall Sensor - G40-

10 - Coolant temperature sensor - G62-

11 - 4 poles connector

- ☐ Black.
- ☐ For Lambda probe - G39- 1 before the catalyser and Lambda probe heating - Z19- .
- ☐ Brown.
- ☐ To Lambda probe after the catalyzes - G130- .

12 - Lambda probe after the catalyser - G130- , 50 Nm

- ☐ Installation location: On the exhaust tube, front part.

13 - Lambda probe - G39-

- ☐ On the exhaust manifold.

14 - Cylinder 1 injector - N30- , Cylinder 2 injector - N31- , Cylinder 3 injector - N32- and Cylinder 4 injector - N33-

15 - Fuel distributor

16 - Magnetic valve 1 for activated charcoal reservoir - N80-



## 1.3 Injection components - remove and install

### 1 - Connector

- ☐ For Engine control unit - J623- .
- ☐ Connect or disconnect the connector only with ignition switched off.
- ☐ Unlock to loosen.

### 2 - Engine control unit - J623-

- ☐ For the injection system, lambda adjustment, Pre-resistance for evaporator fan - N81- , knock adjustment, speed limit, ignition and self-diagnosis.
- ☐ In case of replacement, it is necessary to adapt the Engine control unit - J623- to the Immobilizer control unit  
⇒ [page 144](#) .

### 3 - Connector

- ☐ Black, 4 poles.
- ☐ From the Intake manifold pressure sensor - G71- with the Air intake temperature sensor - G42- .
- ☐ Gold plated connector contacts.

### 4 - Connector

- ☐ Black, 3 poles.
- ☐ From Engine speed sensor - G28- .

### 5 - Air filter set

- ☐ Remove and install the air filter set ⇒ [page 132](#)
- ☐ Disassemble and assemble ⇒ [page 131](#) .

### 6 - Fastening clip

- ☐ Observe model.

### 7 - Cable guide

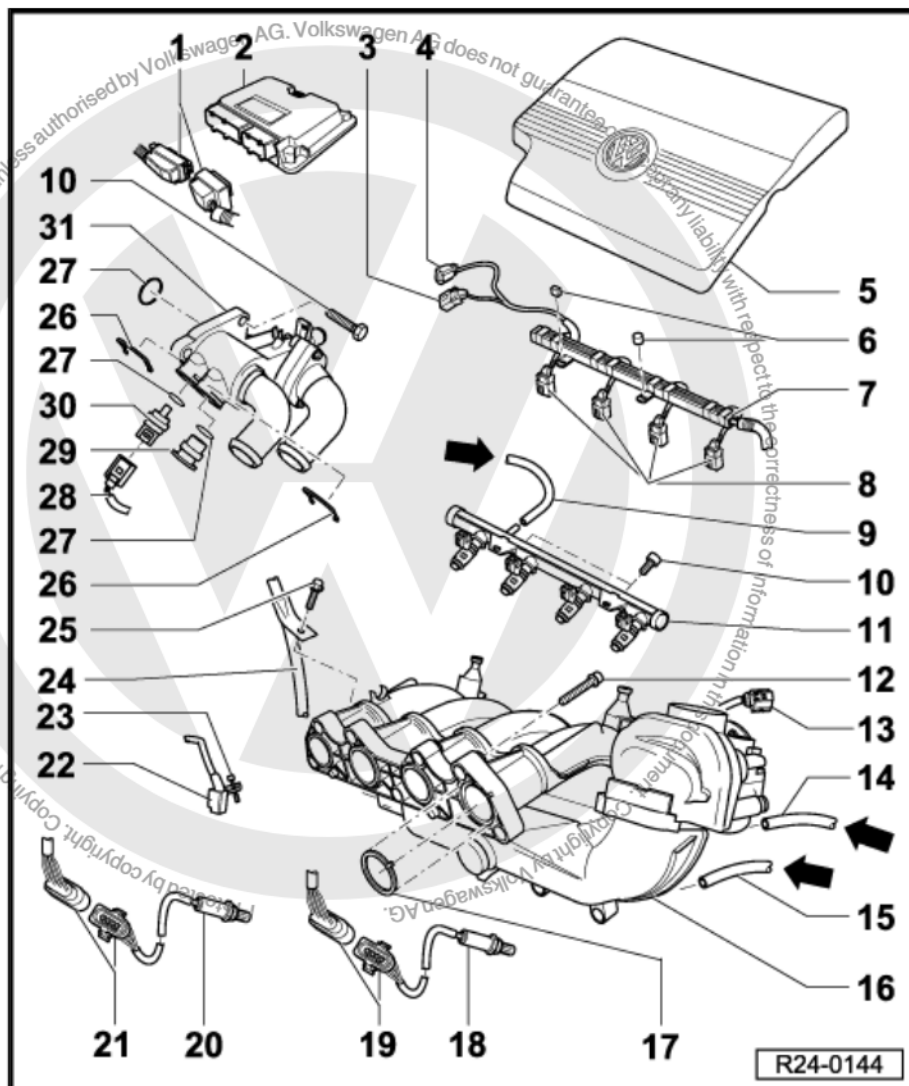
- ☐ Fastened to the fuel distributor.

### 8 - Connector

- ☐ Black, 2 poles.
- ☐ From the Cylinder 1 injector - N30- , Cylinder 2 injector - N31- , Cylinder 3 injector - N32- and Cylinder 4 injector - N33- .

### 9 - Fuel supply lines

- ☐ Black with white mark.
- ☐ Fasten with spring braces.
- ☐ Make sure it is well fastened.
- ☐ From the fuel filter.





10 - 10 Nm

11 - Fuel distributor with injectors

- ☐ Remove and install ⇒ [page 131](#) .

12 - 20 Nm

13 - Connector

- ☐ Black, 6 poles.
- ☐ For Throttle valve control unit - J338- .
- ☐ Gold plated connector contacts.

14 - From the Magnetic valve I for activated charcoal filter - N80-

- ☐ Fasten with spring braces.

15 - For brake servo

16 - Intake manifold

- ☐ Remove and install ⇒ [page 130](#) .

17 - Sealing ring

- ☐ Replace.
- ☐ Check installation position.

18 - Lambda probe - G39- , 50 Nm

- ☐ Lubricate only thread with -G 052 112 A3- ; the -G 052 112 A3- can not enter the grooves of the body of the probe.
- ☐ Remove and install with the Set of sockets for Lambda probe - 3337- .
- ☐ Power is supplied to heat the probe through the Fuel pump relay - J17- .

19 - 4 poles connector

- ☐ Black.
- ☐ To the Lambda probe - G39- Lambda probe heating - Z19- .
- ☐ Contacts 3 and 4 gold plated.

20 - Lambda probe after catalyser - G130- , 50 Nm

- ☐ Lubricate only thread with -G 052 112 A3- ; the -G 52 112 A3- can not enter the grooves of the body of the probe.
- ☐ Remove and install with the Set of sockets for Lambda probe - 3337- .

21 - 4 poles connector

- ☐ Black.
- ☐ From Lambda probe after catalyser - G130-

22 - Engine speed sensor - G28-

- ☐ Installation location. On the engine block, intake side.

23 - 5 Nm

24 - Guide tube

- ☐ To the oil dipstick.

25 - 3 Nm

26 - Clip

- ☐ Make sure it is well fastened.

27 - Sealing ring

- ☐ Replace.

28 - Connector

- ☐ Black, 2 poles.
- ☐ From Coolant temperature sensor - G62- .
- ☐ Gold plated connector contacts.





## 29 - Plug

- ☐ If necessary, depressurize the system before removal.

## 30 - Cooling system temperature sensor - G62-

- ☐ From the Engine control unit - J623- .
- ☐ If necessary, depressurize the system before removal.
- ☐ Resistance values between contact 1 and 2 ➔ [page 129](#)

## 31 - Cooling system thermostat valve body

Resistance values of the Coolant temperature sensor of the cooling system - G62-

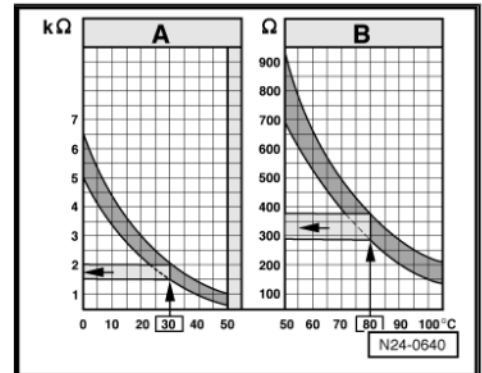
The diagram is divided into two temperature regions:

A - from 0..0.50 °C

B - from 50..00.105 °C

Sample reading:

- ◆ 30° C in region A corresponds to a resistance of 1.5...2.0 kΩ.
- ◆ 80° C in region B corresponds to resistance of 275..0.375 Ω.





## 1.4 Intake manifold - remove and install

### 1 - Sealing ring

- ☐ Replace it if damaged.

### 2 - Accelerator butterfly valve command unit - J338-

- ☐ When replacing, adjust the Accelerator butterfly valve command unit - J338- to the Engine control unit - J623-  
⇒ [page 144](#).

### 3 - 7 Nm

### 4 - 20 Nm

### 5 - Intake manifold

- ☐ Remove and install  
⇒ [page 130](#).

### 6 - Sealing ring

- ☐ Replace after each removal.
- ☐ Observe installation position.

### 7 - Sealing ring

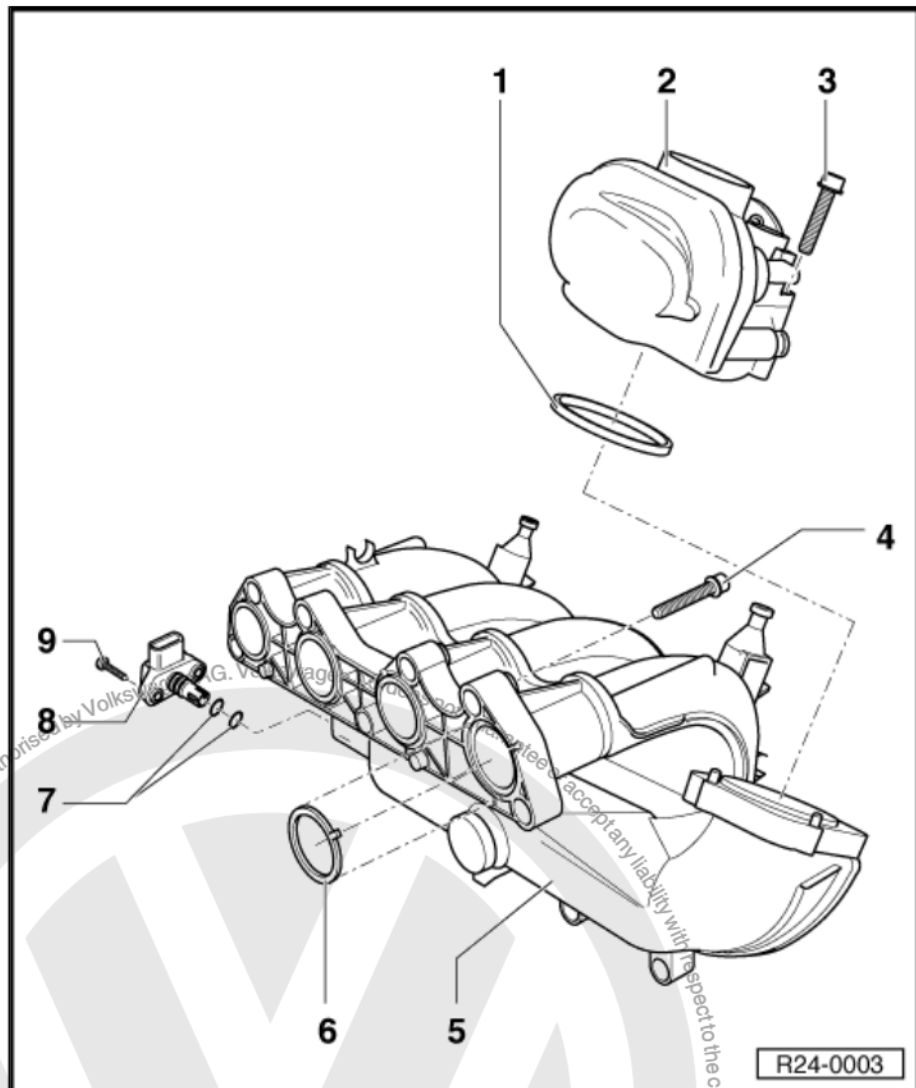
- ☐ Replace it if damaged.

### 8 - Intake manifold pressure sensor - G71- with Air intake temperature sensor - G42-

- ☐ Resistance values of the Air intake temperature sensor - G42- contacts 1 and 2  
⇒ [page 130](#)

### 9 - 3 Nm

- ☐ Observe indications on installation  
⇒ [page 133](#).



### Resistance values for the Air intake temperature sensor - G42-

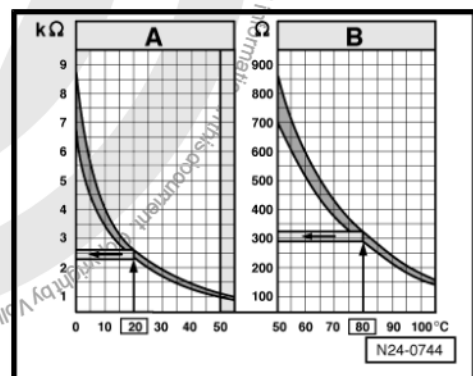
The diagram is divided into two temperature regions:

A - from 0...50° C.

B - from 50...105° C.

Sample reading:

- ◆ 20° C in region A corresponds to a resistance of 2.3...2.6 kΩ.
- ◆ 80° C in region B corresponds to resistance of 290...330 Ω.



## 1.5 Fuel distributor with injectors - removal and installation

### 1 - Fuel distributor

- ☐ Remove and install  
⇒ [page 131](#) .
- ☐ Check fuel pressure  
regulator ⇒ [page 138](#) .

### 2 - 8 Nm

### 3 - Clip

- ☐ Make sure it is well fastened.
- ☐ Observe the proper seating in the fuel distributor and injector.

### 4 - Sealing ring

- ☐ Replace after each removal.
- ☐ Thoroughly lubricate with engine clean oil before installation.

### 5 - Cylinder 1 injector - N30- , Cylinder 2 injector - N31- , Cylinder 3 injector - N32- and Cylinder 4 injector - N33-

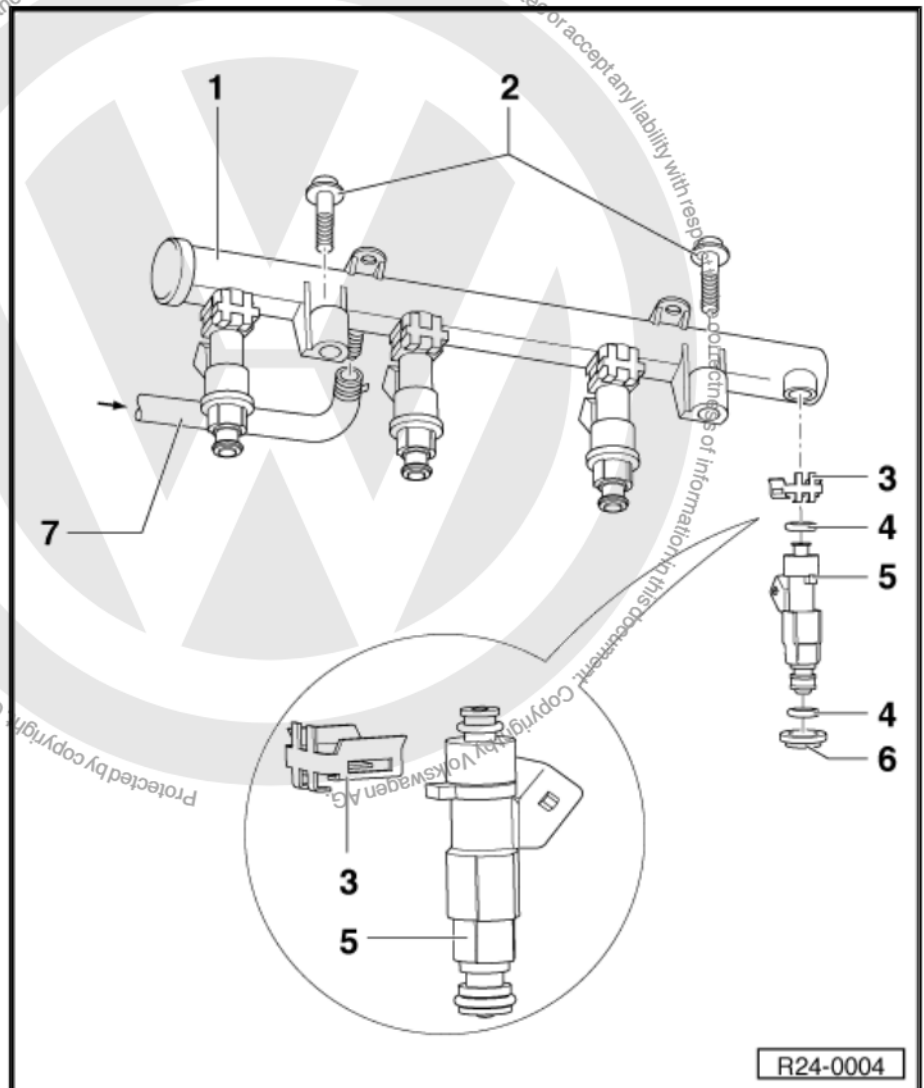
- ☐ Resistance between valve contacts: 7...17 Ω.

### 6 - Sealing ring

- ☐ Observe installation position.
- ☐ Replace when damaged.

### 7 - Fuel supply lines

- ☐ Black with white mark.
- ☐ Fasten with spring braces.
- ☐ Make sure it is well fastened.
- ☐ From the fuel filter.



## 1.6 Air filter set - assemble and disassemble

Remove and install air filter case ⇒ [page 132](#)



1 - Air intake nozzle

2 - Sealing ring

- ☐ Ensure firm seating.
- ☐ Replace when damaged.

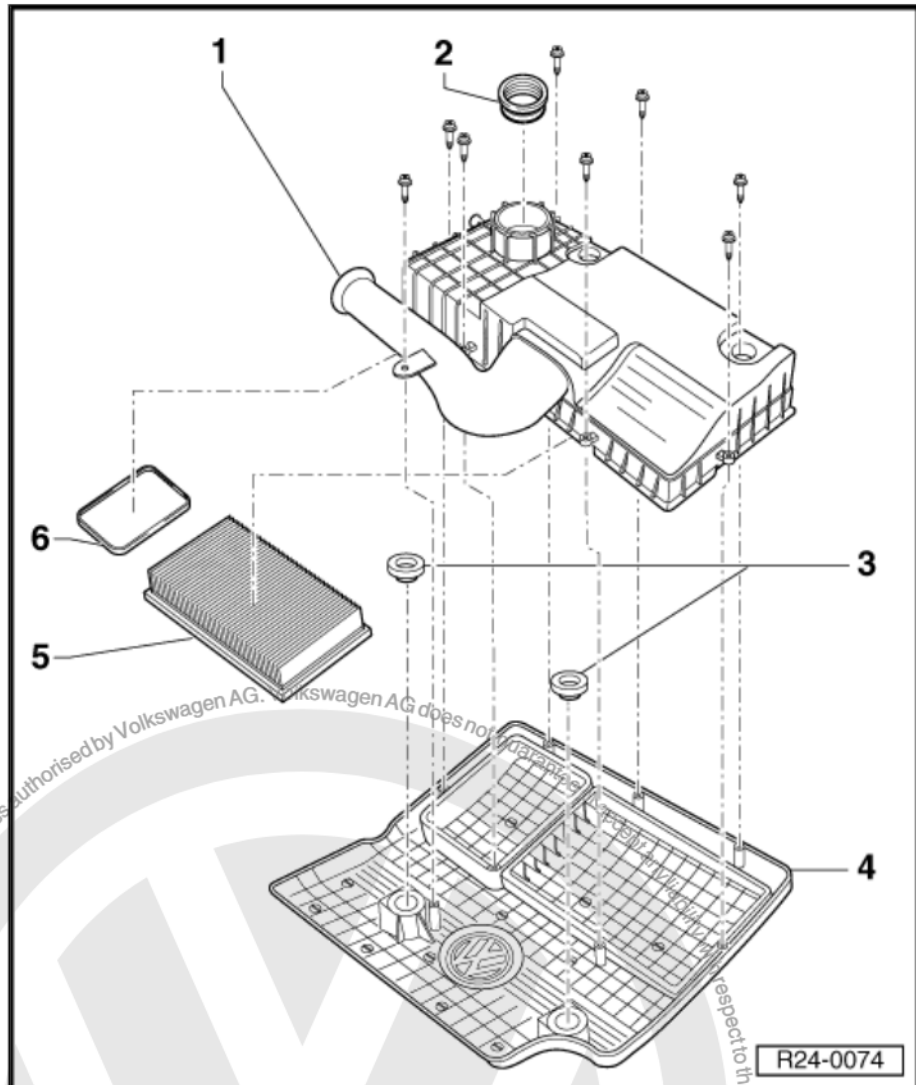
3 - Rubber bearing

4 - Upper part of the air filter case

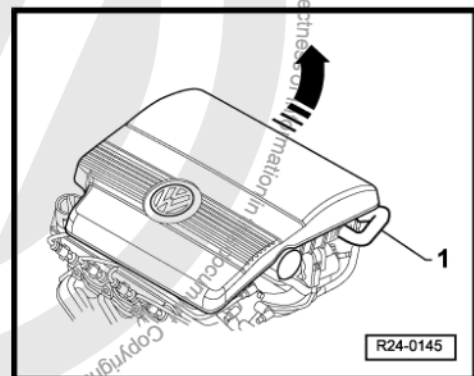
5 - Filtering element

6 - Sealing gasket

- ☐ Observe installation position.
- ☐ Replace when damaged.



Remove and install the air filter housing.



### 1.6.1 Removal

- Remove the crankcase venting hose -1- from the air filter case.
- First, remove the air filter case from its supports and the butterfly valve command unit of the accelerator - J338- and, then, from the front supports -arrow-.



## 1.6.2 Installation

- The air filter case assembly is initially carried out by fitting the accelerator butterfly valve command unit nozzle - J338- , side supports, and then the front supports.
- Apply neutral soap or coolant additive to the fastening bearings and to the Accelerator butterfly valve control unit - J338- at the moment of the installation.



### Note

- ◆ *To fasten the filter upper part to the filter base as well as the air intake nozzles and the Intake manifold pressure sensor - G71- with Air intake temperature sensor - G42- , serial self-locking screws are used. If these screws are loosened or tightened with a power screwdriver, the threads on the upper part of the air filter case can be damaged.*
- ◆ *For that reason, using a power screwdriver is only allowed when:*
- ◆ *The drill speed is 200 rpm at most.*
- ◆ *A torque of 3 Nm at most is adjusted.*

## 1.7 Safety measures



### WARNING

*The fuel system is under pressure. Before loosening hose connections or opening checking junction, place a cloth around them. Then, eliminate the pressure, by carefully removing the hose and loosening the closing screw.*

To avoid personal injuries and/or injection and ignition system damage, observe the following:

- ◆ For safety reasons, fuse 33 must be removed from the fuse box before opening the fuel system.
- ◆ Do not touch or remove the ignition cables while the engine is running or when the engine is starting.
- ◆ Only connect or disconnect the injection and ignition system cables (and measuring device cables) with the ignition switched off.



### WARNING

*Remember the following when performing installation work, especially inside the engine compartment where there is little space:*

- ◆ *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling fluid and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.*
- ◆ *Allow easy access to all the moving or hot parts.*

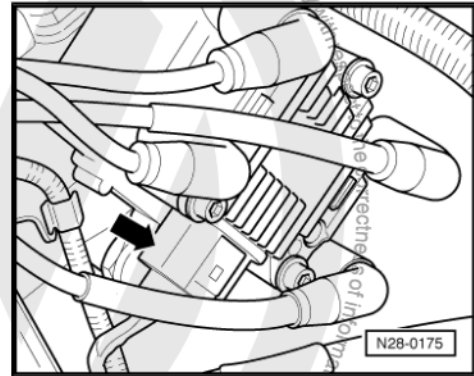
If during a test run it is necessary to use testing and measuring equipment, observe the following:

- ◆ Always install test and measuring equipment on the back seat and have them operated by a second mechanic.



If test and measuring equipment are operated from the passenger seat, the person seated there may be injured should the airbag activate in case of accident.

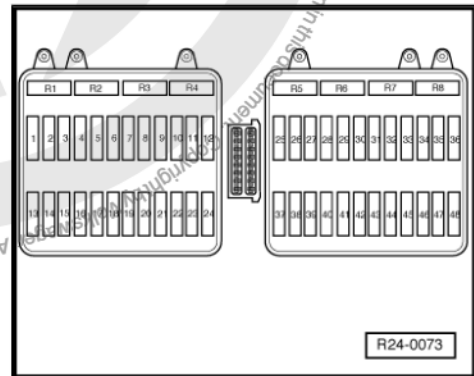
- ◆ If the engine is to be turned over at starting speed, without starting:
- Disconnect the 4-pole connector from the Ignition transformer - N152- -arrow-.



- Remove fuse 44 from fuse box.

**Note**

Removing fuse 44 interrupts the power supply to the injectors.



## 1.8 Cleaning rules

For cleaning, carefully observe these “5 rules” when working on the fuel supply/injection system:

- ◆ Thoroughly clean the connections and surrounding areas before disconnecting them.
- ◆ Place parts on clean surface and cover them. Use lint-free cloths!
- ◆ If the repair work will not be performed immediately, exposed components must be covered or carefully preserved.
- ◆ Install clean components only. Remove spare parts from packaging just prior to installation. Do not install components that have been stored outside of packaging (i.e. inside a tool box, etc.).
- ◆ With the system open: If possible, avoid using compressed air. Do not move vehicle, if possible.

## 1.9 Technical data

Engine codes		BKR
Idle speed check		
Idle speed operation	rpm	670...770 <sup>10)</sup> 700...800 <sup>12)</sup>
Engine control unit <sup>11)</sup>		
System		4EV Marelli
Replacement part number		⇒ Replacement part CD





Engine codes		BKR
Speed limit	rpm	From approximately 6200

10) Non-adjustable. Values for vehicles without air conditioning.

11) Replace the Engine control unit - J623- ➔ [page 143](#) .

12) Non-adjustable. Values for vehicles with air conditioning.





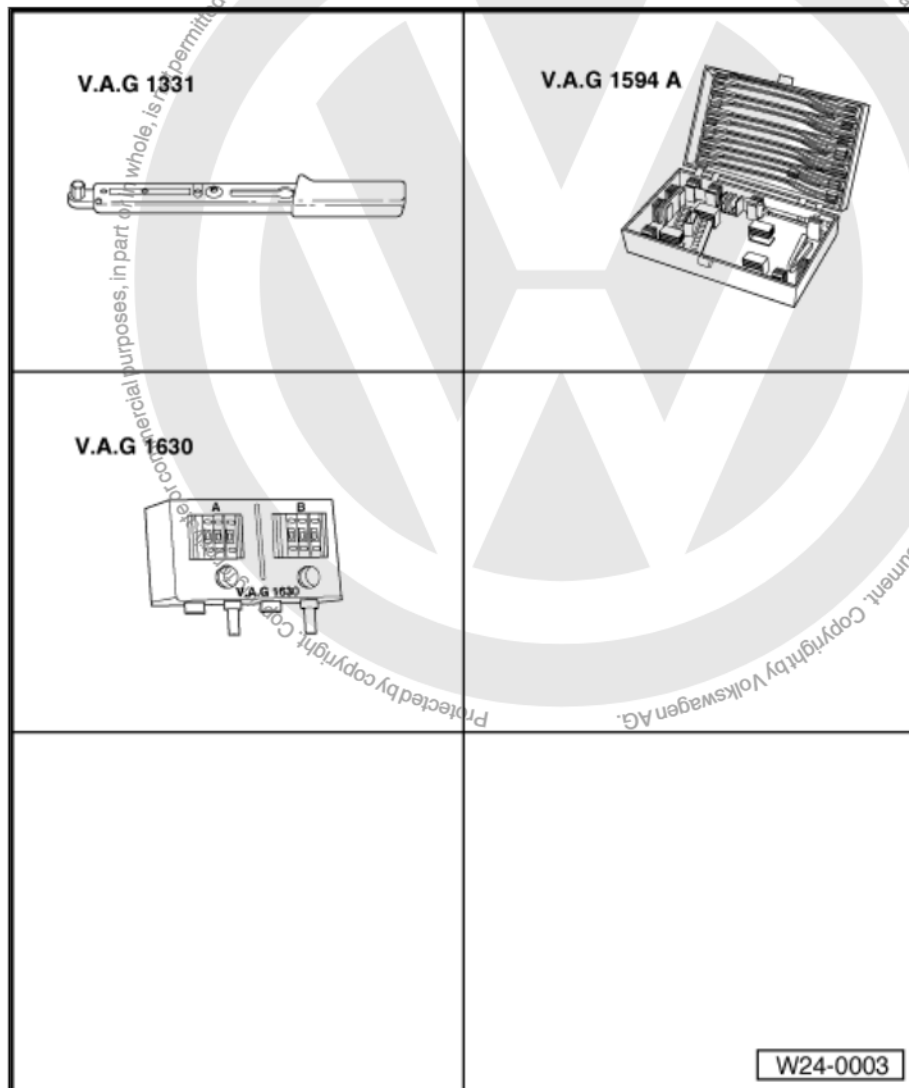
## 2 Component checks

### 2.1 Injection valves - check

Examine the sealant and the shape of the jet

Special tools and workshop equipment required

- ◆ Torque meter - 5 to 50 Nm (enc. 1/2") - VAG 1331-
- ◆ Auxiliary measuring cable set - VAG 1594C-
- ◆ Digital potentiometer (included in VAG 1594C) - VAG 1630-
- ◆ Graduated container



Test conditions

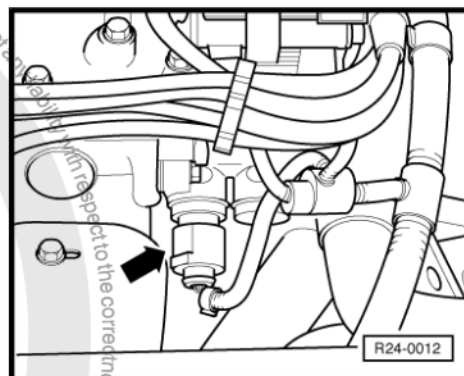
- The fuel pressure must be correct, check ➔ [page 138](#) .

Test sequence

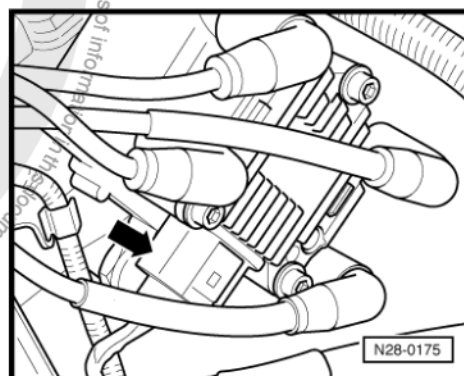
- Remove air filter set ➔ [page 132](#)



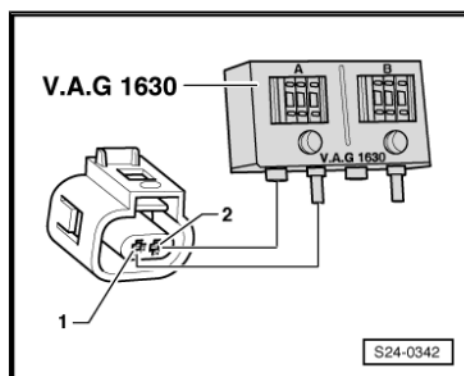
- Disconnect the 2-pole connector from the Cooling system temperature sensor - G62- -arrow-.



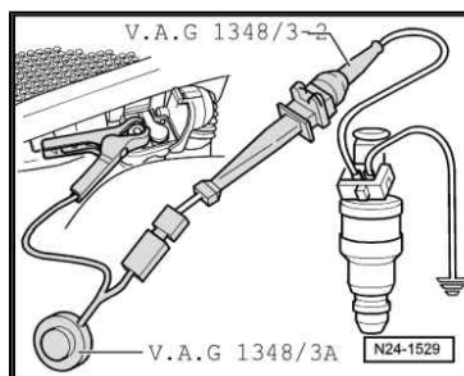
- Disconnect the 4-pole connector from the Ignition transformer - N152- -arrow-.



- Connect the Digital potentiometer (included at VAG 1594 C) - VAG 1630- with the Auxiliary measuring cable set - VAG 1594A- to connector contacts 1+2 and adjust the connected side to 15 kΩ.
- Disconnect the injection valve harness in the fuel distributor.
- Remove the fuel distributor with all injection valves from engine cylinder head (fuel pipes remain connected).
- Connect one contact of the injection valve, to be checked, to the ground of the engine with a Set of measurement auxiliary cables - VAG 1594C- .



- Connect the other contact to the injection valve with the Remote Control - VAG 1348/3A- and the Adapting Cable - VAG 1348/3-2- to the positive side of the Battery - A- .
- Turn on the ignition; the Fuel pump (pre-supply pump) - G6- should work.





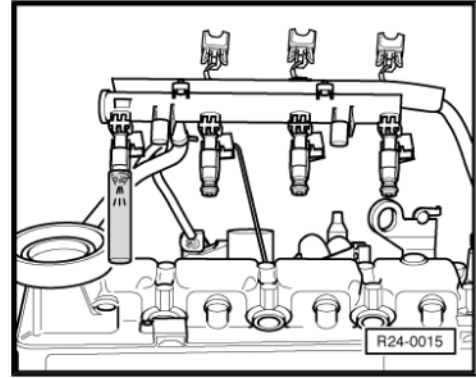
- Keep a small graduated container under the injection valve to be tested and remove the connectors from the remaining injection valves.
- Activate the Remote control - VAG 1348/3A- for 30 seconds.
- Repeat test on the other injection valves. Ensure that only the injection valve being tested is connected.
- Then check the injector valve sealant. Fuel loss cannot exceed 2 drops a minute.

If fuel loss is greater:

- Turn ignition off.
- Replace the damaged injection valve.

The injection valve is installed in the reverse order, observing the following:

- ◆ Rings on all injection valves should be replaced and thoroughly lubricated with clean engine oil.
- ◆ Place the injection valves vertically and in their proper position in the fuel distributor and fasten them with safety clips.
- ◆ Install the fuel distributor with the injection valves on the engine cylinder head and press down uniformly.



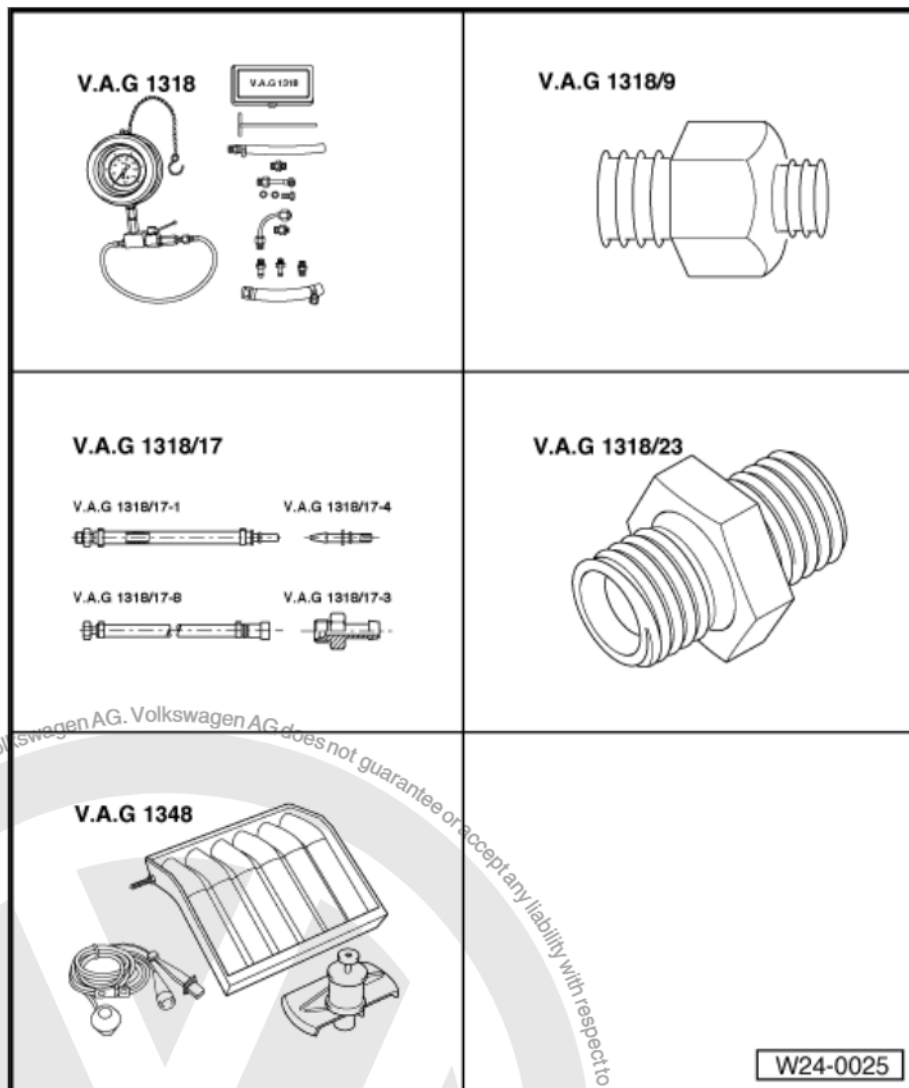
## 2.2 Residual pressure and fuel pressure regulator - check





#### Special tools and workshop equipment required

- ◆ Pressure gauge - VAG 1318-
- ◆ Adapter - VAG 1318/1-
- ◆ Adapter - VAG 1318/17-
- ◆ Adapter - VAG 1318/23-
- ◆ Flow meter - VAG 1348-



### 2.2.1 Pressure - check



#### Note

- ◆ Fuel pressure regulator adjusts fuel pressure to around 3 bar.
- ◆ The fuel pressure regulator is in the Fuel pump (pre-supply pump) - G6-.

### 2.2.2 Checking process

- Remove the fuse box lid.



- Remove fuse 33 from the ( Fuel pump (pre-supply pump) - G6- ) fuse box.



### WARNING

*The fuel system is under pressure. Before loosening hose connections or opening checking junction, place a cloth around them. Then, eliminate the pressure, by carefully removing the hose and loosening the closing screw.*

- Disconnect fuel supply pipes connection -1- and clean spilled fuel with a cloth.



### Note

*To unlock the fuel lines, press the safety key.*

- Install the Pressure gauge - VAG 1318- with Adapting set - VAG 1318/17- and Adapter - VAG 1318/9- .
- Open the Pressure gauge - VAG 1318- valve. The valve will point towards flow direction-A-.
- Put fuse 33 of Fuel pump (pre-supply pump) - G6- back in the fuse box.
- Start engine and allow it idle.
- Check the fuel pressure. Theoretical value: approx. 3.0 bar.

If the nominal value is not obtained:

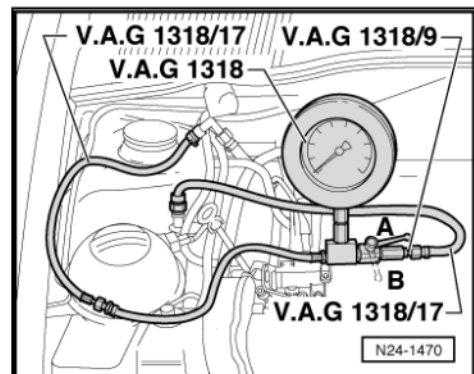
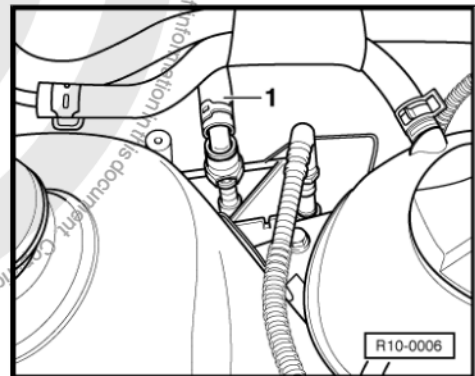
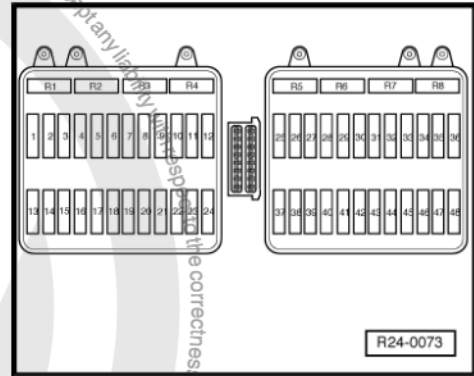
- Turn ignition off.
- Check the Fuel pump (pre-supply pump) - G6- ➔ [page 111](#) retention valve.

If the nominal value is obtained:

- Turn ignition off.
- Check for leaks and residual pressure (in the whole system). For such, check pressure drop using the Pressure gauge - VAG 1318- . After 10 minutes there should still be a positive pressure of at least 2.0 bar.

If residual pressure drops below 2.0 bar:

- Start the engine and keep it idling.







- When the pressure is reached, turn the ignition off, while closing the Pressure gauge - VAG 1318- valve (valve transverse to the blockage direction -arrow-).

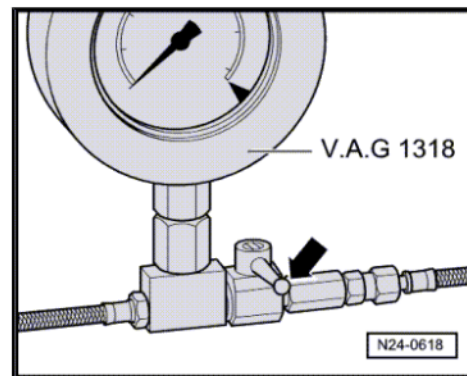
- Check the pressure drop on the Pressure gauge - VAG 1318-.

If the pressure continues dropping:

- Check the connections of the hoses and the Fuel pump (pre-supply pump) - G6-.
- Check the Pressure gauge - VAG 1318- for leaks.

If the pressure does not drop:

- Check the circlips between the fuel distributor and the injection valves, and the hose between the Pressure Gauge - VAG 1318- and the fuel distributor.
- Check Fuel pump (pre-supply pump) - G6- retention valve.



#### Note

*Before removing the Pressure gauge - VAG 1318- , once again place cloths around the hose junctions.*

### 2.2.3 Fuel pressure regulator - check

### 2.2.4 Check conditions

- Retention valve for Fuel pump (pre-supply pump) - G6- OK: check ⇒ [page 117](#) .

### 2.2.5 Checking process

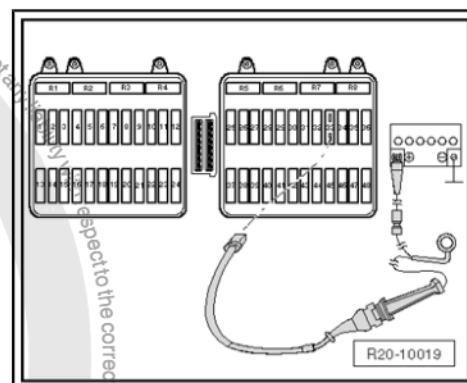
- Turn ignition off.
- Remove the fuse box lid.
- Remove fuse 33 from the ( Fuel pump (pre-supply pump) - G6- ) fuse box.
- Connect the Remote control - VAG 1348/3A- and Adapter cable - VAG 1348/3-2- to the right contact of fuse 33 to activate the Fuel pump (pre-supply pump) - G6- and to the positive terminal of the Battery (+).



#### WARNING

*The fuel system is under pressure. Before loosening hose connections or opening checking junction, place a cloth around them. Next, eliminate pressure by carefully removing the hose.*

- Loosen fuel supply pipes -1- from fuel filter outlet.
- Return pipes -2- (blue), keep connected.
- Fuel filter -3- with the inlet hose.





- Fuel supply pipes (from filter outlet to engine) -4- connect to the measuring equipment outlet.



**Note**

*To unlock the fuel lines, press the safety key.*

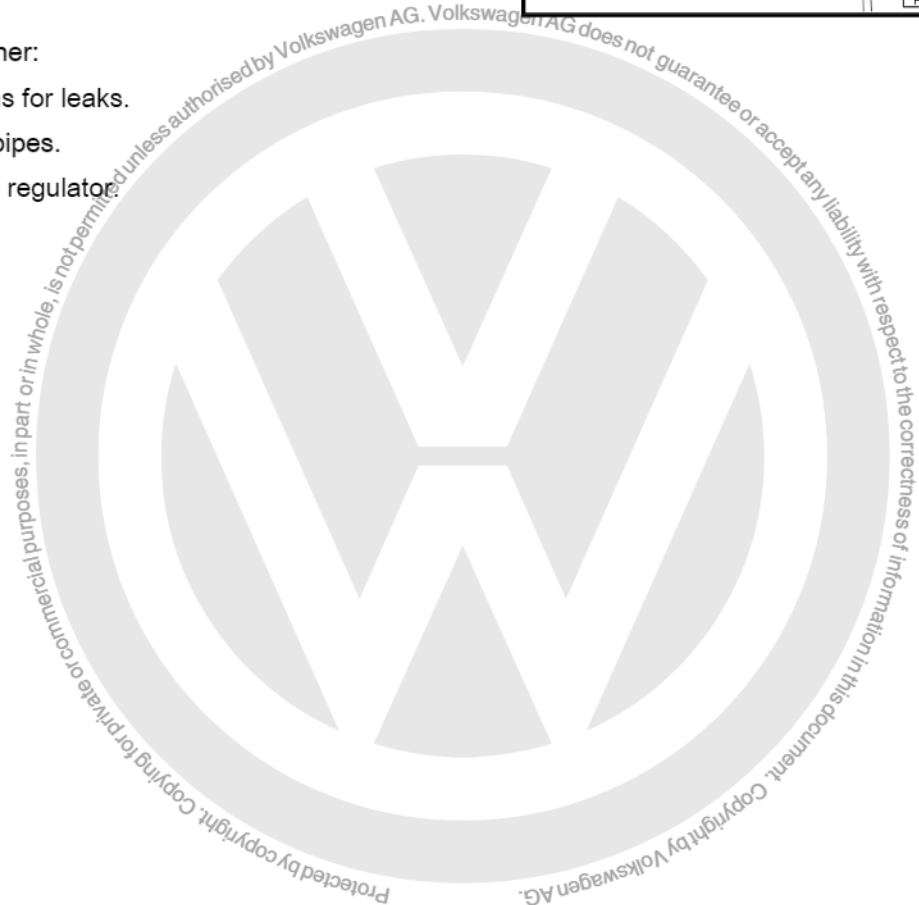
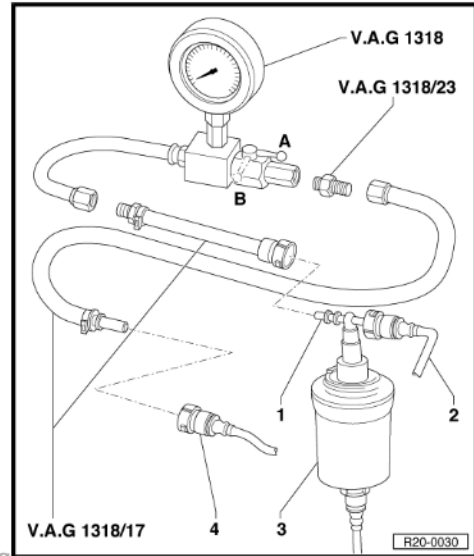
- Connect the Pressure gauge - VAG 1318- with Adapting set - VAG 1318/17- and Connector - VAG 1318/23- as shown.
- Close the passage switch on the Pressure gauge - VAG 1318- (valve transverse to the blocking position -B-) .
- Activate the Remote control - VAG 1348/3A- for approximately 10 seconds to fill the fuel tank and generate system pressure of approximately 3 bar.
- Check the pressure drop on the Pressure gauge - VAG 1318- . After 10 minutes, the pressure should not have dropped below 2.5 bar.

If the pressure drops further:

- Check line connections for leaks.

If no flaw is found in the pipes.

- Replace fuel pressure regulator.





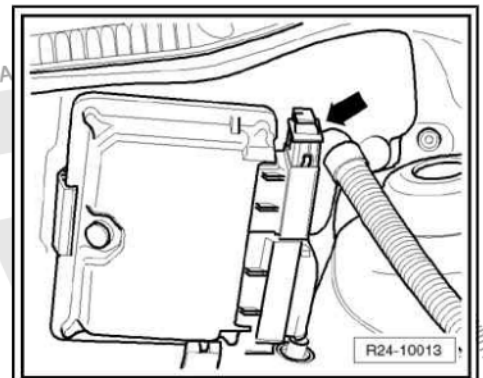
### 3 Engine control unit - J623-

#### 3.1 Engine control unit - J623- - remove and install

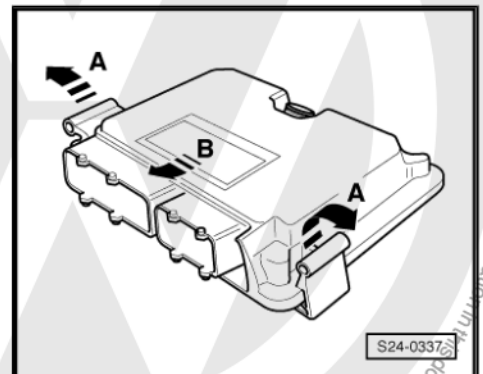
- Before removing the Engine control unit - J623- first check its identification and, with that, also the coding ⇒ [page 144](#) .

##### 3.1.1 Removal

- Turn ignition off.
- Disconnect the fitting connector from Engine control unit - J623- and remove it.



- Press clips -arrows- outwards and pull the Engine control unit - J623- sideways.

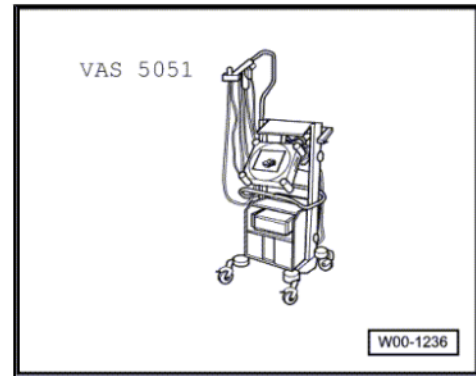


##### 3.1.2 Installation

- Place the new Engine control unit - J623- and press it to the left.
- Connect the connector and lock.
- Adjust the Engine control unit - J623- ⇒ [page 144](#) .
- Refer to the event memory of the new Engine control unit - J623- and, if necessary, erase the event memory ⇒ [page 144](#) .
- Carry out a test cycle.



- Check the fault memory in the Engine control unit - J623-again.



### 3.2 Adjust components

Special tools and workshop equipment required

- ◆ Vehicle diagnostic, testing and information system .

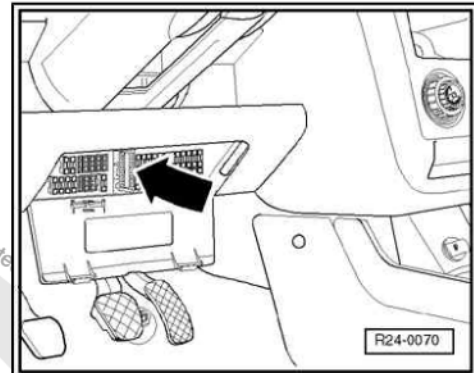
Operation sequence

- Connect the Vehicle diagnostic, testing and information system as follows:
- Place the connector of Diagnostic cable to the diagnosis connection.

Select, in the Vehicle diagnostic, testing and information system the "Assisted troubleshooting".

After consulting all command units:

- Press the **Skip** key.
- Select **Function/component selection**.
- Select **activate**.
- Select **engine identification codes**.
- Select **systems with self-diagnosis**.
- Select **engine control**.
- Select **functions**.
- Select **Function or component**.





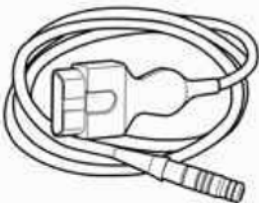



### 3.3 Check Engine control unit - J623- fault memory and clear it



# Special tools and workshop equipment required

- ◆ Vehicle diagnostic and service information system - VAS 5051-
- ◆ Vehicle diagnostic and service information system - VAS 5052-
- ◆ Vehicle diagnostic and service information system - VAS 6150-
- ◆ Diagnostic cable - VAS 5051/6B-
- ◆ Diagnostic cable - VAS 5052/3A-
- ◆ Wireless diagnostic connector - VAS 5054/A-

<p><b>VAS 5051</b></p> 	<p><b>VAS 5052</b></p> 
<p><b>VAS 6150</b></p> 	<p><b>VAS 5051/6B</b></p> 
<p><b>VAS 5052/3A</b></p> 	<p><b>VAS 5054 A</b></p>  <p>Q97-10001</p>

## Operation sequence

- Connect the Vehicle diagnostic, testing and information system as follows:



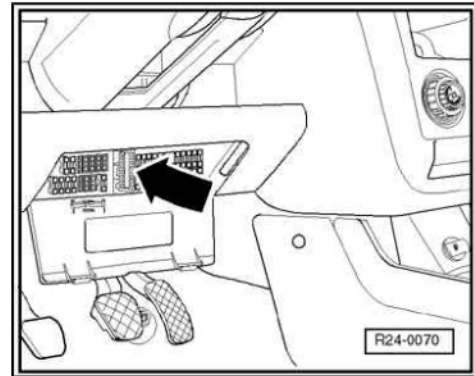
- Connect the Diagnostic cable .
- Start the engine and keep it idling.

Only when engine does not start:

- Turn on the ignition.

Select the operational mode:

- Press the **Vehicle self-diagnosis** on the display.
- Press the **Self-diagnosis** on the display.
- Press key **[ ]**.



The display shows the command unit identifications and the Engine control unit - J623- coding.

Select the vehicle system:

- Press **01 electronic engine** on the display .
- Press key **[ ]**.

Select diagnosis function:

- Press **004 Error memory content** on the display.
- Press key **[ ]**.
- Press **004.01 Check error memory** on the display.
- Press key **[ ]**.
- If no faults are stored in the Engine control unit - J623- , the display shows "0 faults found".
- If there are faults stored in the Engine control unit - J623- , they will be shown sequentially on the display.
- Press key **[ ]**.
- Press **004.10 Erase error memory** on the display.
- Press key **[ ]**.
- Press key **[ ]**.
- Press the **Cancel/End** key.

If the operation is cancelled, press Cancel, if the operation is finalized, press End.





## 4 READINESS code

### Function

The READINESS code is an eight-digit code indicating the status of relevant diagnoses for exhaust gases.

Whenever a system diagnostics (e.g. secondary air system) is successfully conducted, the corresponding digit in the digital code changes its status.

Diagnosis is performed at regular intervals during normal vehicle operation. After doing repairs on an exhaust gas system, it is advisable to generate the READINESS code, to ensure that all systems are functioning properly. If a fault is identified during diagnosis, it will be saved in the event memory.

The READINESS code is erased every time the event memory is erased or when there is interruption in the power supply to the Engine control unit - J623 - .

### 4.1 Creating and Interpreting the READINESS code

Vehicle diagnostic tester



## 26 – Exhaust system

### 1 Exhaust system components - remove and install



#### WARNING

*Always replace self-locking nuts and screws subject to angular torque*



#### Note

- ◆ *After assembly works, make sure the exhaust system is not tensioned and that there is a suitable distance from the body. If necessary, loosen the double and retaining clamps and align the muffler and exhaust pipe so that there is always a suitable distance between it and the body and that the supports have a uniform load.*
- ◆ *Always replace self-locking nuts.*

Exhaust manifold, catalyst and front exhaust pipe with intermediate muffler and installation parts ➔ [page 148](#) .0

Rear muffler with supports ➔ [page 150](#) .

### 1.1 Exhaust manifold, catalyst and front exhaust pipe with intermediate muffler





## 1 - Heat deflector

- ☐ Install without tension.

2 - 10 Nm

## 3 - Exhaust manifold

- ☐ For removal, remove heat deflector and loosen front pipe.

4 - Lambda probe - G39- , 50 Nm

- ☐ Lubricate only thread with -G 052 112 A3- ; the -G 052 112 A3- can not enter the grooves of the body of the probe.
- ☐ Remove and install with the Set of sockets for Lambda probe - 3337- .
- ☐ In case of leakage, cut and replace the sealing ring.

## 5 - Gasket

- ☐ Replace.

## 6 - Heat deflector

## 7 - Heat deflector

- ☐ From alternator.

8 - 20 Nm

9 - Double clamp

10 - Tube

11 - To rear muffler

12 - Self-locking nut

- ☐ 23 Nm
- ☐ Replace after each removal.

13 - Front tube with intermediate muffler

14 - Intermediate muffler

15 - Sustaining handle

- ☐ Replace if damaged.

16 - Self-locking nut

- ☐ 40 Nm
- ☐ Replace after each removal.

17 - Lambda probe after catalyser - G130- , 50 Nm

- ☐ Lubricate only thread with -G 052 112 A3- ; the -G 052 112 A3- can not enter the grooves of the body of the probe.
- ☐ Remove and install with the Set of sockets for Lambda probe - 3337- .
- ☐ In case of leakage, cut and replace the sealing ring.

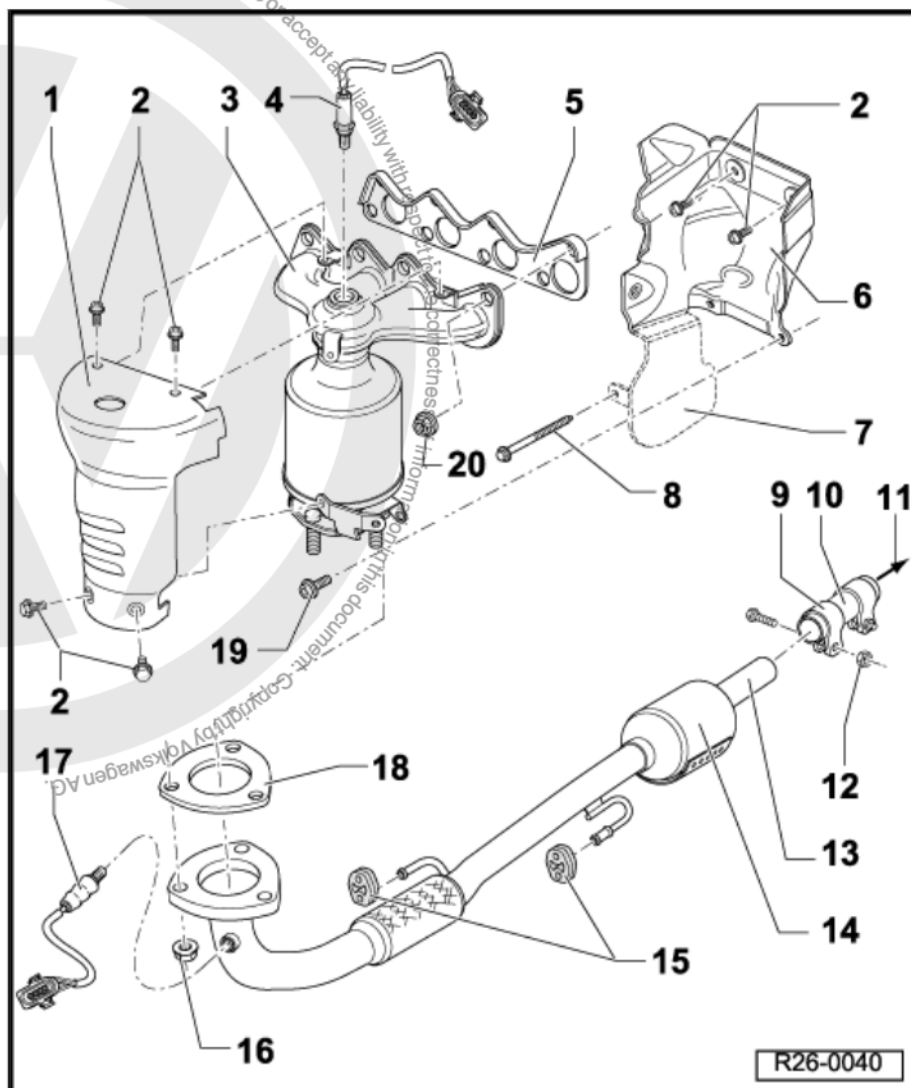
## 18 - Gasket

- ☐ Replace.

19 - 10 Nm

20 - Self-locking nut

- ☐ 25 Nm





- ☐ Replace after each removal.

## 1.2 Rear muffler with supports

1 - Rear exhaust tube

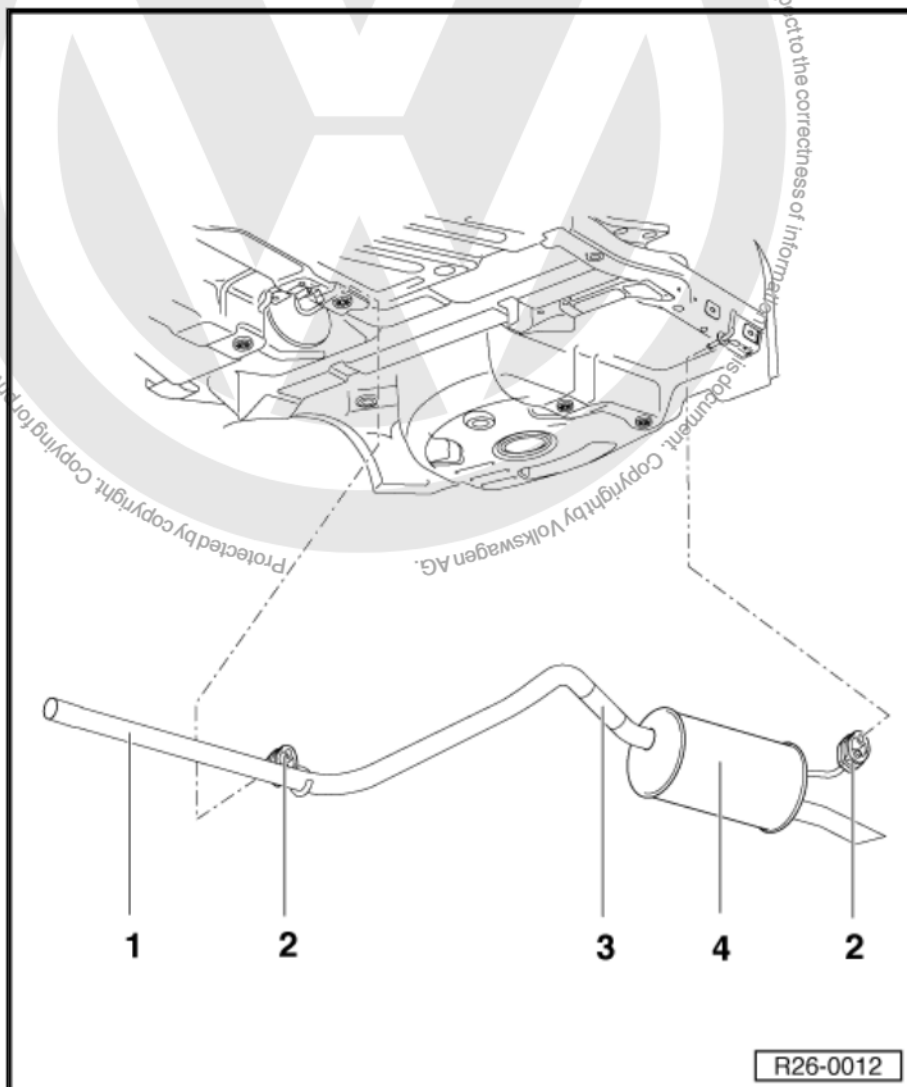
2 - Sustaining handle

- ☐ Replace when damaged.

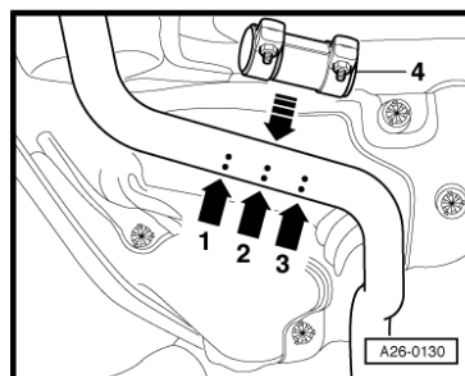
3 - Separation point

- ☐ Identified by dots on connection tube.
- ☐ As standard items, the rear muffler with exhaust tube as one part are mounted. For repair the rear muffler is supplied individually with one double clamp.
- ☐ Perpendicularly separate the connection tube in the separation point with a Pneumatic Saw or VAG 1523A - EQ 7415- ➔ [page 150](#)

4 - Rear muffler



Separation point on the exhaust tube

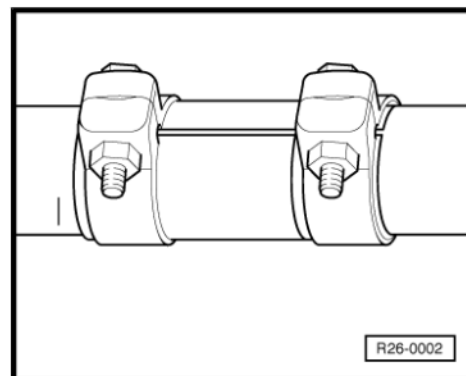




### Clamp mounting position

#### Operation sequence:

- Apply sealing putty in the junctions and, then, assemble the sleeve and clamps on the exhaust tube.
- Align the sleeve so that the junction is exactly in the centre of the sleeve.



### Support bearing position

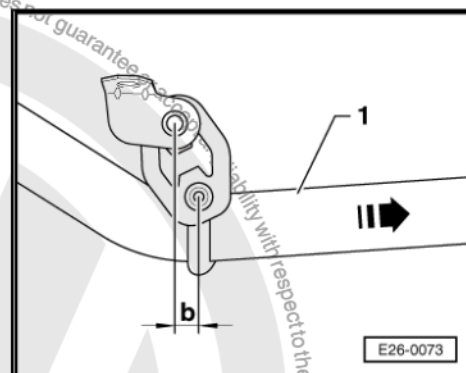
#### Operation sequence:

- The distance -b- between the clamp and the exhaust tube support -1- should be approx. 4 mm.



#### WARNING

*Wear protection goggles and clothing to prevent from injuries caused by metallic filings.*



- Cut exhaust tube in right angle on the -arrow 2-separation point.
- At installation, place double clamp for repair -4- during installation, on lateral identifications -arrows 1 and 3-. Tightening torque 23 Nm.



## 28 – Ignition system

### 1 Ignition system - repair

#### 1.1 General instructions regarding the ignition system

- ◆ This chapter addresses especially ignition system related components. Other injection and ignition system components ⇒ [page 124](#) .
- ◆ A minimum voltage of 11.5V is necessary for the perfect operation of electrical components.
- ◆ In some tests, the Engine control unit - J623- may detect and record a fault. Accordingly, once all tests and repairs are complete, check the event memory and erase it if necessary ⇒ [page 144](#) .
- ◆ If after troubleshooting, repair and component checking, the engine starts for a moment and stops, the immobilizer may be blocking the Engine control unit - J623- . In this case, check the fault memory and, if necessary, adjust the Engine control unit - J623- ⇒ [page 144](#) .

Safety measures ⇒ [page 153](#) .

Checking data, spark plugs ⇒ [page 154](#) .

#### 1.2 Ignition system components - remove and install



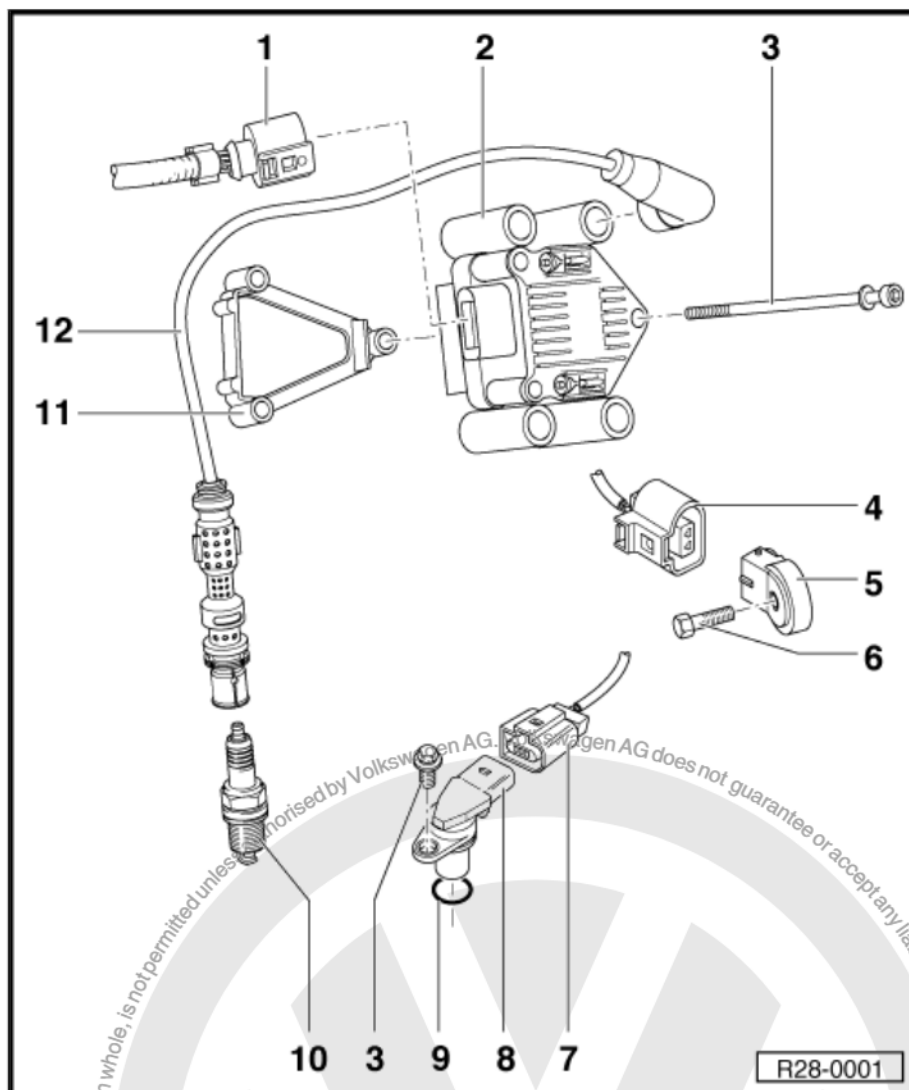
Note

Engine control unit - J623- with connectors ⇒ [Item 7 \(page 126\)](#) .





- 1 - Connector
  - ☐ Black, 4 poles.
  - ☐ To the Ignition trans-  
former - N152- .
- 2 - Ignition transformer - (152)-
  - ☐ Installation location  
⇒ [page 124](#) .
  - ☐ With spark plug cable  
codes: A = cylinder 1. B  
= cylinder 3. C = cylinder  
2. D = cylinder 4.
- 3 - 10 Nm
- 4 - Connector
  - ☐ Black, 2 poles.
  - ☐ For the Knock sensor 1  
- G61- .
  - ☐ Gold plated contacts for  
sensor and connector.
- 5 - Knock sensor 1 - G61-
  - ☐ Installation location  
⇒ [page 124](#) .
  - ☐ Gold plated contacts for  
sensor and connector.
- 6 - 20 Nm
  - ☐ Tightening the torque in-  
fluences the operation  
of the Knock Sensor 1 -  
G61- .
- 7 - Connector
  - ☐ Black, 3 poles.
  - ☐ To Hall Sensor - G40- .
  - ☐ Gold plated connector  
contacts.
- 8 - Hall Sensor - G40-
  - ☐ Installation location ⇒ [page 124](#)
- 9 - Washer
  - ☐ Replace when damaged.
- 10 - Spark plug, 30 Nm
  - ☐ Remove and install with Spark plug wrench - 3122B- .
  - ☐ Type and inter-electrode gap ⇒ [page 154](#) .
- 11 - Support
  - ☐ To the Ignition transformer - N152- .
- 12 - Spark plug cable
  - ☐ With interference suppression and spark plug connector.
  - ☐ Resistance 4.8...7.2 kΩ.



### 1.3 Safety measures

Consider the following in order to avoid personal injury and/or deterioration of the injection and ignition systems:



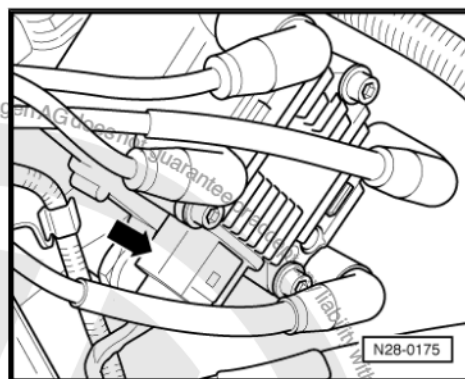
- ◆ Do not touch or disconnect the ignition wires with the engine running or starting.
- ◆ Loosen and connect injection and ignition system wires, including the measuring equipment wires, only with ignition off.

If during a test cycle, it is necessary to use test and measuring equipment, consider the following:

- ◆ Always install test and measuring equipment on the back seat and have them operated by a second mechanic.

If test and measuring equipment are operated from the passenger seat, the person seated there may be injured should the airbag activate in case of accident.

- ◆ If the engine is to be turned over at starting speed, without starting:
- Disconnect the 4-pole connector from the Ignition transformer - N152- -arrow-.

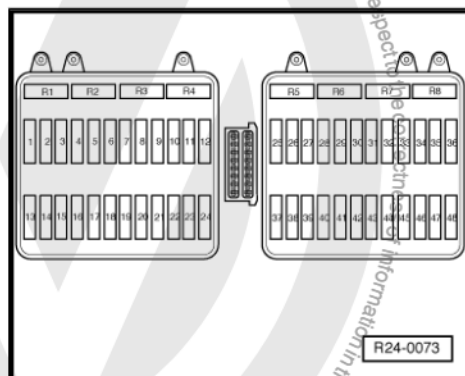


- Remove fuse 44 from fuse box.



#### Note

Removing fuse 44 interrupts the power supply to the injectors.



## 1.4 Test data, spark plugs

Engine codes	BKR
Firing sequence	1-3-4-2
Spark plug <sup>13)</sup> , 2) <sup>14)</sup>	
VW	101/000 062/AB//
Manufacturer denomination	NGK PZFR5D -11
Inter-electrode gap	max. 1,0 ... 1.1 mm
Tightening torque	30 Nm

13) Current values and ignition replacement intervals: = Exhaust gas Test Folder. .

14) Remove and install spark plugs with a SPARK PLUG WRENCH - 3122B- .